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AERIAL AGE
WEEKLY

Vol. 5, No. 1 MARCH 19, 1917 10 CENTS A COPY

Aeronautics Almost Lost From $115,000,000 Naval Emergency Fund

Executive Board of Aero Club of America Passes Resolution of Appreciation of Work of Henry Woodhouse

Training in Military Aviation
By General W. S. Brancker

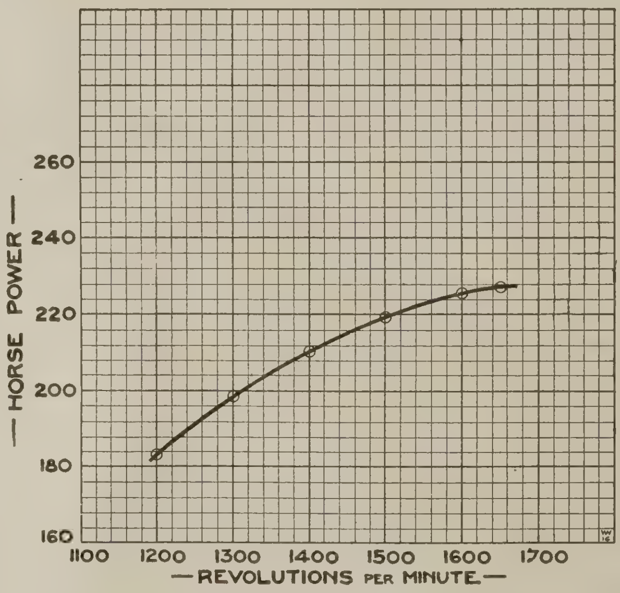
The German Aeroplane Engine Trials

The 1916 Type Rumpler Biplane Described

Curtiss

MODEL VX-3 motor was used by Victor Carlstrom on November 2nd in flying from Chicago to Erie, Penna., a distance of 452 miles, in 3 hours 57 minutes.

Owing to changes and improvements our 5″ x 7″ eight-cylinder motor, formerly known as Model "VX," rated at 160 horsepower, will hereafter be known as Model "VX-3" and will be rated at 200 horsepower. The following is a record of electric dynamometer test of stock motor "VX-3" No. 3512 as delivered from the Production Department:



Duration of Test	1 hr.
Average R. P. M.	1403.33
Average Load on Scales (Lbs.)	449.64
Average Horse Power	**210.26**
Maximum Observed H.P. at 1400 R.P.M.	210.50
Minimum Observed H.P. at 1400 R.P.M.	208.10
Total Gas Consumption (Lbs.)	111.30
Total Gas Consumption (U. S. Gals.)	18.10
Gas Consumption Per Hour (Lbs.)	111.30
Gas Consumption Per Hour (U. S. Gals.)	18.10
Gas Consumption (Lbs. per H. P. Hour)	**.528**
Total Oil Consumption (Lbs.)	6.50
Total Oil Consumption (U. S. Gals.)	.844
Oil Consumption (U. S. Gals. Per Hour)	**.844**
Oil Pressure Start of Test (Lbs.)	71.00
Oil Pressure End of Test (Lbs.)	72.00
Oil Pressure Maximum (Lbs.)	74.00
Oil Pressure Minimum (Lbs.)	68.00
Average Inlet Water Temp. (F.)	116.90
Average Outlet Water Temp. (F.)	140.50

CURTISS AEROPLANE & MOTOR CORPORATION

BUFFALO, N. Y.

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Battleplane with Lewis Machine Gun mounted on bow of car. This plane was the first of its kind in the world

"In my private opinion the Lewis Machine Gun is the best light type gun yet developed for troops in the field."

Major-General LEONARD WOOD,
Commander of the Department of the East.

General Wood stated he "favored having . . . . a reserve supply of 25,000 machine guns as in the end one in ten men will carry a 26 lb. machine gun as he now carries a rifle."

Statement made by Major General Leonard Wood testifying before the Military Committee of the House of Representatives reported in New York World, January 28th, 1916.

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Executive Offices: 50 CHURCH STREET, NEW YORK
Factories: UTICA, NEW YORK

Curtiss J. N.
Tractor
Equipped With
Ackerman Wheels

"IT'S IN THE SPOKES"

AFTER four years' exhaustive tests, The Ackerman Wheel Company offers to aeroplane builders a wheel of special design that will solve many of the difficulties hitherto encountered.

In a series of laboratory tests (see illustrations below) the wheel was attached to a large case, into which was loaded 1,500 pounds of sand. A side thrust blow, with the wheel seven feet removed from the point of contact, was calculated to give the wheel a stress of 27,000 pounds. This was when the wheel struck the plain floor surface. To test the wheel to its maximum, two cleats of wood were nailed to the floor, four inches in advance of the striking point, and under this test four spokes of the wheel were broken. Calculation showed that the energy of the blow totalled 49,800 pounds.

A special alloy, specially treated, is used to meet all conditions that the wheel can be subjected to. The steel receives a special process in the treating, so that it will give the required resiliency, starting at the center of the curve and gradually growing stiffer and stronger both to the hub and relative to the structure of the spoke. The spokes being made on the curve, they are hung on the hinge at the rim, being a unit in the hub, allowing them to open and shut according to the load placed on the hub.

In the aeroplane wheel it is found that the hub will leave the center four inches when maximum loaded, and return to center as load is decreased, without the springs taking a set. There has never before been a wheel invented which would meet any such conditions.

These wheels can be built according to size and weight of any load from 500 pounds up to 5 tons

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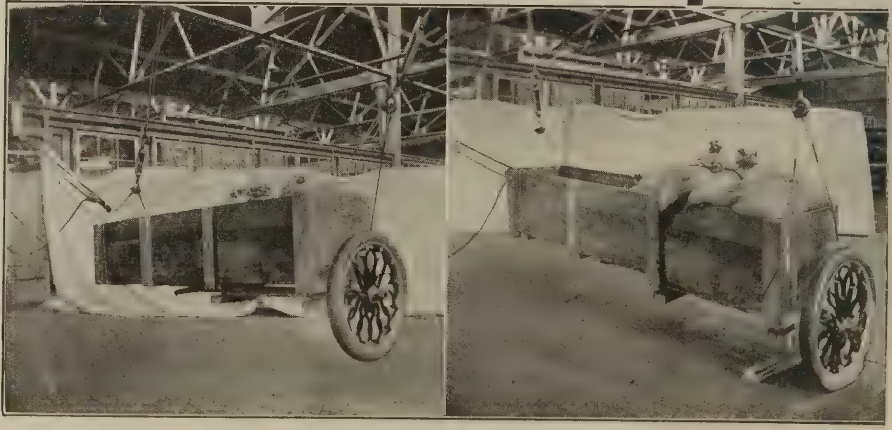

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AERIAL AGE
WEEKLY

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Contributing Technical Editors

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VOL. V NEW YORK, MARCH 19, 1917 No. 1

AERONAUTICS ALMOST LOST FROM $115,000,000 NAVAL EMERGENCY FUND

THE omission of a comma almost eliminated aeronautics from the $115,000,000 Naval Emergency Fund.

Thanks to Senators Poindexter and Lodge, the omission was caught at the eleventh hour, and the Navy Department may now spend whatever is needed to extend the naval aeronautic service out of that appropriation.

We quote the passages from the Senate action which resulted in restoring aeronautics in the Emergency Bill, as it is one of those extraordinary incidents about which one only has read in stories, and it is of utmost importance in showing the eternal vigilance required to protect the development of our aerial defenses. Without that comma the Emergency Fund would be closed to aeronautics and the Navy would be confined to the regular appropriation of $5,130,000, which is far from being sufficient to develop a substantial naval air service.

On March 3d, Senator Swanson laid before the Senate the conference report upon the naval appropriation bill. He had filed the report several hours ago, so that Senators who were interested might find what action has been taken by the House and Senate conferees. The Secretary proceeded to read the report. During the reading the following took place:

Mr. POINDEXTER. Mr. President, I should like to ask the Senator from Virginia what the purpose of the conferees was in changing the emergency appropriation of $115,000,000 so as to eliminate aircraft from the purposes for which it could be used, among others?

Mr. SWANSON. I will say to the Senator that the report does not do that. It increases the use.

Mr. POINDEXTER. Mr. President, the report does do that. It has the peculiar effect of authorizing the purchase of ammunition for aircraft without authorizing the purchase of aircraft.

Mr. SWANSON. No.

Mr. POINDEXTER. The original language of the emergency-fund appropriation did authorize the purchase of aircraft. This one does not. I regret it very much. I only desire to call attention to it. I do not desire to impede the adoption of the conference report for that reason, but simply to call attention to that omission and to express great regret that the conferees have omitted that from the provision, for the reason that aircraft are of constantly increasing importance—one of the greatest needs, in fact, in the enlargement of naval equipment.

Mr. SWANSON. If the Senator will examine the report he will find that he is entirely mistaken.

Mr. POINDEXTER. I am not mistaken, Mr. President. I have head the provision with the greatest care, and I am perfectly competent to understand what the language of it means.

Mr. LODGE. In the amendment to amendment No. 85 there is a word left out by mistake.

Mr. POINDEXTER. It does not provide for aircraft.

Mr. LODGE. It has been left out by mistake. We can correct it by a resolution.

Mr. SWANSON. Let the Secretary read it again.

The Secretary read as follows:

"That the House recede from its disagreement to the amendment of the Senate No. 85 and agree to the same with an amendment as follows: Strike out said amendment and insert:

NAVAL EMERGENCY FUND

"To enable the President to secure the more economical and expeditious delivery of materials, equipment and munitions and secure the more expeditious construction of ships authorized and for the purchase or construction of such additional torpedo boat destroyers, submarine chasers and such other naval small craft, including aircraft guns and ammunition for all of said vessels and aircrafts and for each and every purpose connected therewith, as the President may direct, to be expended at the direction and in the discretion of the President, $115,000,000, or so much thereof as may be necessary, and to be immediately available."

Mr. SWANSON. The only mistake is that there should be a comma after "aircraft," so as to read "aircraft, guns and ammunition." If a comma is put in there, it will make it entirely correct.

The Secretary read as follows:

"Including aircraft, guns and ammunition."

Mr. SWANSON. The purpose is to furnish guns and also ammunition for the aircraft. There was a comma left out. I ask unanimous consent that the unfinished business be temporarily laid aside and that we proceed to dispose of the conference report.

The PRESIDENT pro tempore. Is there objection. The Chair hears none. So the Emergency Appropriation was made available for aeronautics.

VOLUNTEER AERIAL COAST PATROL UNIT No. 2 FORMED

A SECOND volunteer unit of the Aerial Coast Patrol has been formed by prominent young men now completing their course at the Yale University.

Volunteer Aerial Coast Patrol Unit No. 2, as this new unit will be called, has been established with Messrs. G. E. Depew and Frank Goodyear, of Buffalo, as the heads, and through the cooperation of Mr. Robert A. Lovett, son of Judge Robert Lovett, the President of the Union Pacific Railroad, who is a member of Volunteer Aerial Coast Patrol Unit No. 1, of which F. Trubes Davison and H. P. Davison, Jr., sons of H. P. Davison, of J. P. Morgan & Co., Artemus L. Gates, the captain of the Yale team, and eight other prominent young men, are members.

The valuable work of Aerial Coast Patrol Unit No. 1 during the Mosquito Fleet Manoeuvres of last year made it a most distinguished unit, and in the present national crisis, scores of red-blooded Yale men who wish to prepare themselves so as to be of use to meet an emergency have applied for admission in the Aerial Coast Patrol Unit. There are now close to 30 members to Volunteer Aerial Coast Patrol Unit No. 1 who are ready to leave the Yale University in the event of a declaration of war and start training in the operation of seaplanes.

The new Volunteer Aerial Coast Patrol Unit No. 2 will have the cooperation and assistance of Unit No. 1, and Mr. Robert A. Lovett of Unit No. 1 will supervise the training.

The following general arrangements are given in the statement of the organizers of Volunteer Aerial Coast Patrol Unit No. 2 to Real Admiral Robert E. Peary, Chairman of the Aerial Coast Patrol Commission:

1. *Formation:* The Second Unit of the Aerial Coast Patrol has been established with Messrs. G. G. Depew and Frank Goodyear of Buffalo as the heads, and through the cooperation of Robert A. Lovett of the 1st Unit of Aerial Coast Patrol.

2. *Personnel:* Eight men have been chosen as being particularly fitted for such work. These are ready for instant service in case of war. The number will be increased as pilots are graduated.

3. *Training:* a. Model "F" Curtiss boats will be used for the first period of training. The schooling machine is ready for immediate shipment to the training quarters.

b. Instructions will be given by an expert water-flier, and assistance by amateurs.

c. The Jekyl Island Club of Brunswick, Ga., has been kind enough to place its equipment at our service, and the location is ideal for schooling and experimenting, since the island is privately owned and the bay secluded.

d. In the event of war not coming before the close of college, training will be given on Lake Erie with the assistance of the Curtiss Company.

4. *Machines:* In case of need the "F" boat will immediately be shipped to Jekyl Island. These machines will be added, two of the pontoon type to meet the practice of the Navy Department.

5. Instruction in navigation and wireless will start here in New Haven and be continued regardless of the course of national events.

6. Prominent Buffalo men will act as advisers.

7. *Plan:* In the event of a declaration of war or upon notification that our services would be of assistance to the Navy, we are ready to leave at once and start training. Arrangements have been made with the college authorities, and everything else is ready for instant mobilization.

The officials of the Aerial Coast Patrol Commission are: Real Admiral Robert E. Peary, Chairman; Senator Charles F. Johnson, Senator Morris Sheppard, Representative Julius Kahn, Representative Charles Lieb, Representative Murray Hulbert, Hon. Byron R. Newton, Asst. Secry. of the Treas., Hon. William M. Ingraham, Asst. Secy. of War., Dr. E. Lester Jones, Supt. U. S. Coast & Geodetic Survey, Dr. H. C. Frankenfield, Chief Forecaster, U. S. Weather Bureau, Hon. Emerson McMillin, Mr. John Hays Hammond, Jr., Member Board of Governors, Aero Club of America, Mr. Alan R. Hawley, Pres., Aero Club of America; Mr. Henry Woodhouse, member, Board of Governors, Aero Club of America.

Panama Defences and Aircraft

(Editorial in New York *Sun*)

THE prompt response of General Goethals to the very definite assertions recently made by Mr. Rex Beach that the Panama Canal is without adequate defence in time of war will go far to restore public confidence. It will be remembered that prior to his assignment to duty at Panama General Goethals, then Colonel, was a distinguished member of the National Board of Fortifications, and his opinion on so technical a subject as the adequacy of the canal's defences should be promptly accepted even against that of a successful literary man.

The point at which the General concedes weakness in the canal's defences is in the provision for aeroplanes and anti-aircraft guns. This weakness, however, is common to all our defences, even those of New York. The United States, home of the inventors of the modern aeroplane, has of all nations been last to recognize the value of aircraft in military and naval operations. There are more planes today used as playthings by our young millionaires than are at the command of our two armed services. There are more American boys flying in France, risking and giving up their lives in the cause of the Allies, than are carried on the rolls of the aviation corps at home.

This condition will be remedied now that the navy bill has appropriated $5,000,000 for aviation purposes and permits the use of further sums from the $115,000,000 emergency fund. It is fortunate that aircraft, unlike ships, can be built in a few weeks, and that the training of a skilled pilot can be perfected in from four to six months, as demonstrated in the military training schools of Europe.

The Secretary of the Navy, being now provided with funds and authority, should lose no time in beginning the creation of an effective aviation corps—for despite a few machines and pilots now in service, systematic work to that end cannot be said to have begun.

Leading Organizations Endorse Plan to Get 5,000 Aviators for National Defense

The Rotary Club, the Georgia Technology Club of New York, the Pennsylvania University Club of New York, The Traffic Club, the Alumni of the Packer Institute and Brooklyn Heights Seminary, are among the organizations addressed on the subject of aerial preparedness by Mr. Henry Woodhouse in the past two weeks.

While the text of the address delivered at each was different, the part dealing with the necessity of upbuilding our aerial defenses concluded each time with the vital necessity of getting and training 5,000 aviators for national defense. The sugestion is always received with rousing applause and expression of endorsement.

Of the address delivered by Mr. Woodhouse to the Rotary Club on March 8th, the Brooklyn *Times* says:

Henry Woodhouse, managing editor of Flying and governor of the Aero Club of America, recognized as the best informed man on aeronautics in this country was the principal guest and speaker today at the luncheon of the Rotary Club at the Bossert. It was also entirely through the efforts of Mr. Woodhouse, under the authority of Alan R. Hawley, president of the Aero Club that the recent National Aeroplane Fund was created out of which grew the appropriations by Congress of seventeen million dollars for equipping the army and navy with aeroplanes and training aviators.

Mr. Woodhouse said in part:

"The army and navy, which has the best air fighters, holds the supremacy of the air, and while being able to get information about every movement of the enemy, have it in their power to prevent the enemy from getting any information. That may be said to be responsible for all the victories of the present war.

"The nations are making frantic efforts to increase the number of their aeroplanes and aviators. It is known that England, Germany and France have over 10,000 aviators each, one-third of whom are in daily service. Every effort is being made to increase their number, also the number of aeroplanes, dirigibles, observation balloons and anti-aircraft defenses.

"It has been estimated that England spent $250,000,000 on her air service during the last twelve months. The Royal Flying Corps alone has about 350 officers. There are 107 aeronautic stations in Great Britain alone, and the personnel of the British and Naval Flying Corps is said to employ about 500,000 men. Canada has a budget of $80,000,000 to be spent on aeronautics and has just ordered 200 aeroplanes.

"I would like to touch upon the development of the torpedoplane which makes it possible for a $20,000 device to be a worthy match for a $20,000,000 battle cruiser.

"It is not possible to go at length into the employment of aeroplanes for submarine warfare and to give a description of scientific instruments developed, the higher development of the science of aerial photography, the value of dirigibles and observation balloons as auxiliaries for the navy and the development of aerial gunnery.

"An idea of America's share in making aeronautics what it is today can be had from the recent cable despatch from England, in which it was stated that an American-made machine had carried eight persons, 600 gallons of gasoline, guns, ammunition and other equipment, and had made a speed of 78 miles an hour; also from the fact that the best aeroplane guns and instruments are American inventions."

EXECUTIVE BOARD OF THE AERO CLUB OF AMERICA PASSES RESOLUTION OF APPRECIATION OF WORK OF HENRY WOODHOUSE

THE Executive Committee of the Aero Club of America, at its March 7th meeting, unanimously adopted the following resolution:

WHEREAS, Mr. Henry Woodhouse, having, in the opinion of the Governors of the Aero Club of America, earned an acknowledgment of their appreciation of his extraordinary achievements on behalf of the aeronautical movement, the movement for national preparedness for defense, and the club, and

WHEREAS, the many undertakings initiated and so successfully carried out by Mr. Woodhouse and his associates having proven of great value to the aforesaid movements, and the club, and

WHEREAS, among these activities should be mentioned the following:

The creation of the Pan-American Aeronautic Federation, by means of which the sportsmen of the Americas have been united in a common undertaking of great usefulness;

The creation and successful conduct of the National Aeroplane Fund, by means of which the American aeronautic industry when at its lowest ebb was revived, and the public aroused to the need of active military and naval aeronautic preparation;

The stimulation of Congress to vastly increase its aeronautical appropriations;

The instigation of the movement to interest college students in aerial defense, and the development of aeronautics;

The establishment and successful conduct of the recent Pan-American Aeronautic Show;

Together with other services which he has rendered, and

WHEREAS, by these activities and his untiring devotion to the cause for which the Aero Club of America stands, and to his colleagues, Mr. Henry Woodhouse has won the admiration and esteem of his fellow governors, therefore

BE IT RESOLVED: That the Board of Governors of the Aero Club of America hereby tenders to Mr. Henry Woodhouse its thanks, and this expression of its appreciation of the invaluable services which he has rendered to the nation, the aeronautic movement, and the club.

Henry Woodhouse

Mr. Woodhouse is a Most Useful Citizen

Mr. Woodhouse has given sixteen hours daily to developing aeronautics for the past six years. Before that, for a number of years, he gave from four to six hours daily. Although only 33 years old, he has traveled widely. According to the biography printed in the National Cyclopedia, Mr. Woodhouse was born in Turin, Italy, being the son of a prominent manufacturer. He early developed a taste for literary work, and having traveled extensively through France, Switzerland, England, Belgium and Italy, he improved every opportunity for studying modern languages and science, especially economics, sociology and aeronautics. He came to the United States in 1904 and took out his naturalization papers in 1909. Almost immediately after his arrival in this country he became a contributor to such periodicals as *Collier's Weekly, McClures, Metropolitan, The Independent* and *World's Work.*

There was a growing demand for articles on aeronautics, the development of which he had followed since boyhood, and he wrote largely on that topic, in one year averaging 3,000 words a day for the entire year. In 1911, with Robert J. Collier and Henry A. Wise Wood, he founded the aeronautical monthly magazine *Flying,* of which he became managing editor. He contributed to *Flying* many instructive and timely articles; he prophesied the development of military aeronautics, the extensive employment of aeroplanes by armies and navies in future wars, and the development of the hydroaeroplane, with which Glenn H. Curtiss had just begun to experiment. Being a deep student in economics and sociology, he pointed out the uses of aircraft to solve problems of transportation. As early as 1912 he urged the employment of aeroplanes as mail carriers between points inaccessible by rail. The science was then in its infancy; fatal accidents were numerous, and the general public was skeptical of the practicability of aviation. The aeronautical authorities of the country told him he was ahead of his time, and his associates advocated the suspension of *Flying,* but Mr. Woodhouse was firm in his belief that the aeroplane had come to stay. He had the courage of his convictions and continued the periodical at his own expense. He decided to go on until $20,000 of the $25,000 which he had was spent. *Flying* is today the foremost authority on the subject of aviation in the United States.

Always well-informed, optimistic and far-seeing, he rendered valuable service to the science by encouraging and advising inventors, aviators and workers in the aeronautical field. His early articles on military aeronautics stand as prophecies fulfilled. He had made a careful study of the military institutions in the United States and Europe. What appeared to be over-estimation in 1910-13 regarding the value of the aeroplane for military service, reads today like sane interpretations of the trend of events.

The happy processions of a wonderfully resourceful mind, and an everlasting desire to be of service to the world in general, he has the remarkable faculty of being able to consider the problems of a dozen people who may come to consult with him and to quickly analyze their baffling problems and suggest solutions for them. As a result his advice is sought widely and for most important matters. His advice is always free—but if it is not about aeronautics he promptly introduces aeronautics in the subject or plan in some way. This has resulted in creating interest in aeronautics in practically every line of human endeavor.

Besides being a fluent writer Mr. Woodhouse is a fluent speaker and delivers several addresses to organizations each week.

His practical support to the aeronautic movement has been as substantial as his moral support. Mr. Woodhouse never asks anybody to do what he would not do himself, therefore he begins by doing it himself. If there is a bill to be footed for expenses for developing something worth while, he begins by subscribing himself. For instance, he paid all the expenses of developing the Pan-American movement since 1911, and subscribed the first $1000 for the preliminary expense of holding the First Pan-American Aeronautic Exposition. When he founded the National Aeroplane Fund, he subscribed the first $1000, and continued giving to the Fund in different ways for eighteen months. Another of the many instances, Mr. Woodhouse started the fund for the training of Observation Balloon Operations with a personal contribution of $250; and there are men under training for the U. S. Army Aerial Reserve Corps whose expenses to "get there" were paid by Mr. Woodhouse.

Like Mr. Alan R. Hawley, Henry A. Wise Wood, Rear Admiral Peary and the other leaders of the aeronautic movement, Mr. Woodhouse has received and receives a great many offers to participate in commercial enterprises. It is quite logical that people who have been financed or have secured business amounting to hundreds of thousands of dollars should offer commissions to those who assisted or advised them. Such offers are duly and firmly declined. Those who make the offers are invited to "forget it," but to do for others, if the opportunity presents itself, as has been done for them.

His aim and motto is to do "what is the best for the largest number of people, for the longest time."

Before the European war Mr. Woodhouse was an active peace worker and wrote articles and delivered addresses on the subject, expressing his belief that the factors which would bring world-peace would be aerial transportation and wireless intercommunication, causing the intermixing of people and their interests, just as the railroad, telegraph and the telephone brought more closely together the people of the North and the South of the United States, thereby eliminating the differences caused by the Civil War. But in 1913 he saw indications of a coming conflict and started to urge national preparedness. In August, 1913, he contributed a prophetic article to *Flying* entitled "The Empire of the Air," which gave the air strength of the nations at the time. This article concluded as follows:

"The United States is the only country that is not contesting for the empire of the air. Far from it, it has not even as yet recognized the potentiality and economy of aerial armament. The Army and Navy combined have just a score of aeroplanes, of which half are old training machines, many dangerously worn; of dirigibles we have none. And we have no equivalent for these, either, our mobile army counting just 90,000 soldiers, and our navy having just stepped back one step and taken fourth position. This big, prosperous country is, therefore, open to attack and undefended. At present we are, by strenuous efforts and large expense in diplomatic negotiations, at peace with the world; how long that will last is a problem. With the alarming economic conditions in Europe, continuous warfare among our neighbors, the general aggressive spirit of nations, it rather seems that we ought to be as alarmed as Great Britain is."

Since then he has been an ardent advocate of the National Defense movement, and was active in urging upon the American public by voice and pen the seriousness and importance of a stronger national defense. He was the founder of the National Aeroplane Fund; a permanent delegate to the Conference Committee on National Preparedness, and a member of the Committee of One Thousand appointed by Mayor Mitchel of New York. In 1915 he founded the AERIAL AGE, a weekly, and he is president of the Aerial Age Co., Inc., and also the Flying Association, Inc. In 1916 he founded *The Aeronautic Library* and the *Aeronautic Photo and News Service*. He is a governor of the Aero Club of America, was the founder and a director of the American Society of Aeronautical Engineers, which has been merged with the Automobile Engineers; is Educational and Industrial delegate, Pan-American Aeronautic Federation; a member of the National Aerial Coast Patrol Commission, the Economic Club, the American Association for the Advancement of Science, the National Arts Club; a councillor of the American Civic Association; member of the Ways and Means Committee of the World's Court League, a governor of the Patriotic Educational Society, a governor of the National Institute of Efficiency, and also a member of the Society Automobile Engineers, American Academy of Political and Social Science, the National Press Club, the Authors' League of America, the League for Political Education, the League to Enforce Peace, the National Geographical Society, the American Red Cross, the Twilight Club, the Navy League, the National Security League, the Merchants Association of New York, the American Forestry Association, and an honorary member of the Aero Club of New England. He was a delegate to the second Pan-American Scientific Congress in 1916; also delegate from New York, apointed by Governor Charles S. Whitman, to the Congress of Constructive Patriotism, Washington, January, 1917; and to the American Civic Federation Convention.

Last week he was appointed secretary of the Central Committee on Aeronautics, which is co-operating with the Commandant of the Third Naval District in organizing the Naval Reserve Force, and chairman of the sub-committee on equipment.

THE NEWS OF THE WEEK

U. S. Navy Orders 16 Dirigibles

WASHINGTON, March 12.—Purchase of sixteen non-rigid dirigible airships for coast and harbor patrol work, at a total cost of $649,250, was announced to-day by the Navy Department.

The Curtiss Aeroplane Company of Buffalo was awarded three for $122,250; the Connecticut Aircraft Company, New Haven, two for $84,000; the Goodyear Tire and Rubber Company, Akron, Ohio, nine for $360,000, and the B. F. Goodrich Company of Akron two for $83,000. Deliveries will begin within 120 days.

The airships are the first of such type to be bought by the navy. They will be 160 feet in length, 31½ feet in diameter or 50 feet high over all, will be equipped with radio communication and 100 horsepower motors capable of making a continuous flight of sixteen hours at thirty-five miles each and a maximum speed of forty-five miles an hour for ten hours.

Aeroplanes Seek Surveyors Lost in Florida Swamps

Jacksonville, Fla.—Aeroplanes are skimming the Everglades searching for three New York engineers who are believed to be lost.

The party consisted of John W. King, his son, John W. King, Jr., and William Gattlow. They had been doing much survey work in the Everglades during the winter, and four weeks ago left Miami by boat to investigate the Tamiami Trail.

The boat carried provisions for three weeks, and the party was to have returned to Miami a week ago Saturday at the latest. Several days passed, and when they did not arrive, several Seminoles were sent out on the trail. They penetrated twenty miles into the swamp and found nothing.

When they reported no success the Curtiss Aviation School was consulted, and Philip Rader, chief instructor, made three wide-sweeping flights over the Everglades, with a passenger always looking down into the swamp and jungle. hoping to get sight of the three lost engineers. Other aeroplanes have been sent out, all of them keeping close to the ground, but nothing has been seen of the lost men. The search is being continued.

Aero Club Banquet to be Held at Waldorf-Astoria

New York.—The annual banquet of the Aero Club of America is to be held this year at the Waldorf-Astoria on the evening of March 30

Export of Aeroplanes

New York.—Since our last report the export of aeroplanes and parts have been as follows: To Great Britain, $78,322; to Bermuda, $34; total, $78,356.

Examination for Navy Aero Post

Washington.—There is a vacancy in the Navy Yard for a graduate of some recognized technical school or university who has had five years' experience and who can satisfy the requirements. The pay is $4,000 per year.

The duties of the job consist in the direction and interpretation of tasks of aeronautical engines and the design of engines and research work. The applicant should have a broad training in engineering and mathematics.

The examination will be conducted on March 20.

Sentries to Shoot Air Spies

San Francisco.—Sentries are under orders to shoot to kill any aviator flying over the fortifications of this port. The order was issued by Major-Gen. J. Franklin Bell, commander of the Western division of the army, after an aeroplane was observed yesterday flying over Forts Miley and Winfield Scott.

The airman, traced to his hangar in Alameda, across the bay, was discovered to be Jacob R. Struble, a wealthy engineer and amateur aviator, who said that if he had violated a warning issued ten days ago by army officers for aeroplanes to keep away from coast military reservations he had done so unwittingly.

Seven Military Planes in Flight at San Diego

San Diego, Cal., March 7.—A squadron of seven military aeroplanes, led by Lieutenant R. L. Taylor, of the Connecticut National Guard, flew from the Signal Corps Aviation School, at North Island, to Los Angeles and return to-day. The aeroplanes, flying in fleet formation, flew at an average altitude of six thousand feet and at an average speed of seventy miles an hour.

Lieutenant W. A. Robertson, who was lost for nine days in the Sororo desert with Colonel Harry Bishop when they lost their bearings while on a flight from San Diego to Calixco, January 10, acted as rear guard for to-day's cross-country jaunt.

The flight was made as a test for the first 1917 class of junior military aviators. Those who handled the control wheels in addition to Lieutenants Taylor and Robertson were aviation students Lieutenants Benjamin Wier, B. W. Mills, H. B. Anderson, E. L. Naiden, George Pulsifer, B. F. Byrom, J. T. McNarney, W. W. Winne, C. W. Howard and Thomas Hanley.

Lieutenant Taylor, piloting the Curtiss tractor No. 61, ascended at half-past seven A. M., the remaining six aeroplanes then ascended at five minute intervals. Forming in fleet formation over Point Loma the flotilla headed for Los Angeles, landing at Dominguez field at nine o'clock. At Los Angeles the five aviators who did not pilot machines on the flight north were given the control wheels for the southbound air voyage. Lieutenant Taylor landed at North Island at half-past twelve P. M. He will complete his graduating tests tomorrow, and will have the distinction of being the first National Guardsman to graduate from the signal corps aviation school with the rank of junior military aviator. He has been under instruction less than ninety days.

Lieutenant Millard F. Harmon, one of the army aviators ordered to France for flying duty with the French flying corps, was married to-day. His bride was Miss Alberta B. Clark, daughter of Charles A. Clark, director of the American Hardware and Plumbing Company, of Maila.

Mrs. H. P. Whitney Flies from Palm Beach to Miami

Miami, Fla., March 7.—Mrs. Henry Payne Whitney and Mr. Henry Worthington Bull flew from Palm Beach to-night in an aeroplane and joined Mr. Whitney on board his yacht the Whileaway. They made the trip of seventy-two miles in an hour.

While this was not Mrs. Whitney's first trip in an aeroplane, it is the longest one she ever had made. She was enthusiastic over the experience.

Hawaiian Aviation Activities

Honolulu.—Modern advances in "preparedness" are cleverly shown on the float entered by the Aero Club of Hawaii in the Preparedness Parade. The setting is the wireless station at Pearl Harbor, Uncle Sam's great landlocked fortress, with the three huge masts towering above the lochs. In the waters of the lochs rides a grim-looking battleship, and above soars a miniature aeroplane.

The aeroplane was constructed under the direction of Lieut. R. C. Holliday, secretary of the Aero Club of Hawaii. It is a faithful model of a Curtiss J.N.4 tractor biplane, finished in the dun-color of the modern plane, and has a miniature flyer operating it. The propeller is attached to a motor operated as the float moves. The biplane is one-tenth natural size. This entry, depicting the most modern of modern inventions, proved a striking contrast to the scenes from ancient Hawaii which passed in advance.

The Aero Club of Hawaii were guests at a luncheon given by the Honolulu Commercial Club in the club rooms of the latter organization.

Tables were laid for more than three hundred guests.

General F. S. Strong, president of the Aero Club, introduced Mr. Clifford Harmon of New York who spoke very interestingly on the subject of "Aviation, Past, Present and Future." At the conclusion of his remarks, General Strong thanked Mr. Harmon for his courtesy in addressing the two clubs, and the Commercial Club for the generous spirit shown by them in affording the members of the Aero Club the opportunity of hearing Mr. Harmon's interesting remarks.

Captain John F. Curry, Aviation Section, Signal Corps, arrived on the February transport from San Francisco and has taken up the work of preparing the ground for the arrival of the equipment and personnel for the Sixth Aero Squadron which he is to command.

The equipment is expected to arrive in the Islands in April or May of this year.

Army and Navy News

Sergt. James R. Graham, of the Signal Enlisted Reserve Corps, is assigned to active duty in the Aviation Section, Signal Enlisted Reserve Corps, with station at the Curtiss Aviation School, Miami, Fla., Feb. 24, 1917. (Feb. 24, War D.)

Sergt. Samuel B. Eckert, Signal Enlisted Reserve Corps, Fort Monroe, Va., to active duty in the Aviation Section, Signal E.R.C., with station at the Curtiss Aviation school, Newport News, Va., Feb. 26, 1917. (Feb. 26, War D.)

Under the provisions of the National Defense Act, approved June 3, 1916, the 3d Aero Squadron, Signal Corps, will be organized near San Antonio, Texas. The commanding general, Southern Department, will complete the organization by assigning to this squadron enlisted men of the Aviation Section now in or to be sent to his department.

1st Aero Squadron.—Columbus, N. M.

2d Aero Squadron.—1st Co. Fort Mills, P. I.

3d Aero Squadron.—Fort Sam Houston, Texas.

Aviation.—Cos. A, San Diego, Cal.; B, Mineola, L. I., N. Y.; C, Memphis, Tenn.; D. Fort Sam Houston, Texas; E. Fort Omaha, Neb.

Major Benjamin D. Foulois, junior military aviator, Signal Corps, from duty in Southern Department and will report to commanding general of that department for duty to accompany troops to a point nearest Washington, and then repair to Washington for duty in office of Chief Signal Officer. (March 6, War D.)

Capt. Townsend F. Dodd, junior military aviator, Signal Corps, from duty at Columbus, N. M., to San Antonio, Texas, for duty as department aviation officer, relieving Capt. Benj. Foulois, S. C. (March 6, War. D.)

Signal Enlisted Reserve Corps

Sergt. William E. Lewis, S. E. R. C., to active duty in Aviation Section at the Curtiss Aviation School, Newport News, Va., March 6. (March 6, War D.)

Sergt. Leon Richardson, S. E. R. C., to active duty in Aviation Section at the Curtiss Aviation School, Newport News, Va., March 6, 1917. (March 6, War D.)

The following sergeants of S. E. R. C. to active duty in Aviation Section at the Curtiss Aviation School, Miami, Fla., March 6, 1917: William J. Foy, Frank D. Croxford, Augustus F. Horn and William B. Rodgers, jr. (March 6, War D.)

Sergt. Lloyd L. Harvey, S. E. R. C., to active duty in the Aviation Section at the Curtiss Aviation School, Newport News, Va., March 6. (March 6, War D.)

Sergts. William G. Schauffler and Harold M. Gallop, S. E. R. C., from active duty in the Aviation Section at the Curtiss Aviation School, Newport News, Va., March 10, to their homes. (March 6, War D.)

Sergt. Christopher C. Cole, of the S. E. R. C., to active duty in Aviation Section at Signal Corps Aviation School, San Diego, Cal., March 10. (March 6, War D.)

The following sergeants of the Signal Enlisted Reserve Corps are assigned to active duty at the Curtiss Aviation School, Miami, Fla., March 6: Henry A. Theed and George E. Olmsted. (March 3, War D.)

The following sergeants of the Signal Enlisted Reserve Corps are assigned to active duty at the Curtiss Aviation School, Newport News, Va., to take effect March 6, 1917: Cecil G. Sellers, John A. Hambleton and Harry M. McCuistion. (March 3, War D.)

The following sergeants of the Signal Enlisted Reserve Corps are assigned to active duty in the Aviation Section, Signal Enlisted Reserve Corps, with station at the Curtiss Aviation School, Newport News, Va., March 6, 1917: David H. Young, Thomas E. P. Rice, Alexander H. Williams, jr., and William A. Munn. (March 6, War D.)

Triplane Success Established

The enthusiastic preliminary report made by Capt. William G. Ocker, Aviation Section, Signal Officers' Reserve Corps, after his experiments with the new triplane at the Newport News (Va.) Aviation School, has been borne out by later and more complete tests, it is learned. As a result four machines of this type have been ordered for immediate delivery to as many schools and it is more than probable that seventy triplanes—enough for two coast defense squadrons—will be secured in the near future. Some officers connected with the Aviation Section are so convinced of the superiority of the new design tually it will supplant the biplane as the main reliance of our air service. These officers (they are all qualified to speak as aeronautic experts), are at a loss to explain the persistency with which the French government has clung to the monoplane, in view of the fact that experiments here seemed to fully demonstrates the superiority of the biplane over that type in everything except speed; and now the biplane appears to be about superseded.

Capt. F. T. Evans, of the Aeronautic Station at Pensacola, who recently looped in a seaplane.

Captain Ocker's experiments are being continued at the Virginia school. When this duty is concluded he will be assigned as assistant to Robert Glendenning, the wealthy Philadelphia aviator who is to be made a major in the Signal Officers' Reserve Corps, and placed in charge of a military aviation school to be established at Essington, Pa.

Army Airmen to Go to France

Major William Mitchell, of the Aviation Section, Signal Corps, with Lieut. Joseph E. Carberry, of the same section, and Lieuts. Millard F. Harmon, jr., and Davenport Johnson, who have been detailed from the Infantry to duty with the 1st Aero Squadron at Columbus, N. M., will sail from New York on March 20 for Paris to act as "aviation observers" on the French front. Since the beginning of the war the French government has repeatedly invited our War Department to send over young aviation officers who could study at first hand the great strides made in that arm of the service in recent years. The four officers will look particularly into the organization of the French aviation service behind the front.

Major Benjamin D. Foulois, junior military aviator, Signal Corps, U. S. A., now in command of the air squadron at San Antonio, Texas, that they do not hesitate to predict that even-with the title of "department aviation officer," has been ordered to Washington to take the position in the headquarters of the Aviation Section left vacant by Major William Mitchell, detailed as observer in France. Major Foulois's place will be taken by Capt. Townsend F. Dodd, also a junior military aviator in the Signal Corps. Orders relieving Captain Dodd from duty at Columbus, N. M., were published March 8.

Capt. H. A. Dargue, U. S. A. aviator, and Emil J. Simon, government radio engineer, at San Diego, Cal.

Fifty enlisted men from the U. S. Army Aviation Training School, at San Diego, Cal., left on February 28 for San Francisco, from which port they were to sail on the transport Sheridan for Honolulu, where they will be stationed with the Seventh Aero Squadron. This squadron, a seaplane unit, will comprise eighteen skilled aviators and about 160 men when recruited to full strength. Sixteen seaplanes are to form the flying equipment of the squadron, which will be commanded by Capt. John F. Curry, U. S. A. The first of these machines is expected to reach Honolulu about May 1. Fifty more mechanicians from North Island as the nucleus for the 6th Aero Squadron for duty at Panama will leave for the Canal zone this month.

Government Prepares to Take Over San Diego Site

United States District Attorney Schoonover is preparing the abstract of the land recently purchased by the United States, at San Diego, for headquarters of the aviation service on the Pacific Coast. The land consists of 237 acres, lying on what is known as Dutch Flat, at the north end of San Diego Bay, and an appropriation of $250,000 has just been made by Congress. The property has been purchased of the San Diego Securities Company. With the completion of the abstract, the title to the land will pass to the government.

The Bridgeport Aviation Corps

Bridgeport, Conn., March 14.—That the great number of applicants for admission to the aeronautic section of the Third Division, Connecticut Naval Reserves, has made the formation of a second section here necessary, that four Connecticut men headed by a Bridgeport manufacturer are in training at Pensacola, Florida, and that the state has given a huge plot of ground at Westport to the corps to be used as an aviation field, were among the facts announced to-day by Lieutenant Albert J. Merritt, who has charge of the aviation work of the reserves.

With the formation of a second section there will be 46 men and 11 officers engaged in aviation work in connection with the naval reserves. Four fliers have been promised by the government, three more by private owners who are members of the corps, and it is planned to raise enough money to buy a fully equipped scout cruiser.

Considerable difficulty was experienced in obtaining a suitable field. But this problem was solved when a search of land records revealed that the state owned a huge site on the shore of the harbor near Westport. It had not been used in many years, and had been generally forgotten.

The plot is cut up by a few small strips of private land, but these immediately will be condemned and taken over by the state. A grant of all this land has been given the aviation corps, and work on the erection of hangars and barracks will be started in the near future.

Aero Club for Mass. Tech.

Interest in preparedness at the Massachusetts Institute of Technology took concrete form on March 6, when, at a meeting attended by more than 200 students, it was decided to form an aero club and offer its services to the United States in the event of war. A committee of five—Capt. E. S. Gorrell, U. S. A., instructor at the Institute; P. D. Scheeline, E. P. Warner '17, John Braisten '18 and C H. Tavener '18—will draw up a constitution for the organization, which is to hold its first meeting in the course of the coming week.

Capt. Gorrell was asked to deliver an address. He informed the students that he would talk to them in an unofficial capacity, and then told them it was the purpose of the United States War Department to establish aero training schools for civilians.

He made an earnest plea for the aviation corps. He declared that the service is a most attractive one, and urged all possible to interest themselves in it.

The students were informed that it would be the endeavor of the War Department to so conduct the camps that they would not interfere with the school work. The students were also told that those who qualified would be given commissions as first lieutenants in the officers' reserve corps.

E. P. Warner of the faculty outlined the prospects in aeronautical work. He urged the students in that branch of engineering to give careful weight to the problem, and said that work in the club would be valuable from a patriotic as well as a professional standpoint.

Ellehammer Visits Orville Wright

I. C. H. Ellehammer, of Copenhagen, Denmark, one of the pioneers of aviation in Europe, recently visited Orville Wright in Dayton. The Copenhagen inventor comes with the design of a new motor for which he has very great expectations.

MINEOLA DEVELOPING AS AN AVIATION CENTER

THE Army Aviation Field at Mineola, Long Island, which a year ago was known essentially as the place where a score of National Guardsmen were training with funds raised by the Aero Club of America is developing and becoming an important military aviation center.

So far, it has been a school for preliminary training, but arrangements are now being made to teach the students in the most modern methods of both offensive and defensive aerial combat. There are fourteen aeroplanes and the twenty-two students include six student instructors and members of the Aerial Reserve Corps and of the First Aero Corps, N. Y. N. G., and the Signal Corps, U. S. A., and twenty-four more will be added soon.

Three weeks ago there was announced by the military authorities that fifty machines and 250 students would be sent to Mineola within a week. Machines have been sent, but not the students. Therefore, the six senior instructors are still practically idle. The weather is, of course, unsuited for preliminary flying training, but the students could be taught the rudiments, of aerodynamics, aeroplane and motor construction, instruments, meteorology, etc.

Additional buildings are needed to accommodate additional students and that, more than anything else, is holding up progress. During the last part of the Summer and Fall it was failure on the part of the Washington office of the U. S. Aviation Section to send students to be trained. They had hundreds of applications from men anxious to join the Aerial Reserve Corps, but the administrative staff was not sufficient to attend to the applications.

Captain Joseph E. Carberry is in charge of the Mineola field, assisted by Captain W. G. Kilner and Captain Shepler W. Fitzgerald.

The six senior instructors are: Bert Acosta, Archibald L. Allen, W. Leonard Bonney, A. W. Briggs, P. C. Millman and M. Bjorklund.

These instructors, like the officers in charge fly at every opportunity, under severest conditions. A few days ago Bonney looped the loop four times in rather severe weather.

Everything is done at Mineola that can possibly be done under the restrictions imposed by circumstances. For teaching the modern methods of both offensive and defensive aerial combat, as it is planned, there will be required fast pursuit machines, which have a speed of close to 120 miles an hour, and the large types of battleplanes, or bomb carriers, which are armed actually passed the Reserve Military Aviators' to fight off the attacks of pursuit machines. Also aeroplane guns, long distance wireless sets, etc. No pursuit machines have as yet been delivered; and there is only one battleplane available, the twin-motored Curtiss biplane equipped with the Sperry stabilizer, which enables the pilot to let go of the controls to manoeuver the gun. There are not yet any aeroplane guns available at Mineola, nor long distance wireless sets. Nor are there observation balloons or training dirigibles.

Every opportunity is taken to do constructive work and conduct experiments of educational importance. Recently a film was taken to illustrate the training of aviators. Among the problems devised for the advanced students, these problems comprise methods of recognizance both visual and photographic.

In order to simulate conditions of actual combat in the air, Captain Joseph E. Carberry, in command of the School, is arranging to obtain a camera so devised that by pulling a trigger the pilot can photograph a machine which he is pursuing, simulating the action of a machine gun in actual warfare. By taking a series of pictures of the pursued aeroplane, it hoped that the pilot of the pursuing machine will gain actual experience in the manoeuvering of his aeroplane and obtain visible evidence of his success in these manoeuvers. The camera will be mounted in the same position as a machine gun would be and it is assumed that if a pilot is successful in shooting a hostile machine with a camera, he would be successful, in warfare, in doing it with a gun.

Later the students will be given a chance to operate machine guns which will be carried by pursuit plans having a maximum speed of 105 miles an hour. Eight of these have been ordered by the Government and six will be shipped to the field at Mineola.

A most interesting experiment at the field was one made a few days ago, when rockets were attached to the struts of several machines. The rockets were exploded by an electrical device and were intended to be effective in destroying war balloons. Captain Carberry has made application to the Army balloon station at Omaha for balloons with which to experiment in this way.

Bomb dropping to test accuracy is also taken up. To afford better protection to the hangars, flood lights have been set up on towers near the front of the hangars.

The field is under armed guards, no one not having a pass being admitted at any time.

A dozen or so of the aviators who were trained to fly by private contributions last year and have tests have applied for admission in the Aerial Reserve Corps, and have been admitted. These include Captain R. C. Bolling, Philip A. Carroll, Lieut. James E. Miller, Cord Meyer, Charles Reed, Seth Low, Jr., Frederick Blakeman, H. H. Salmon, Jr., Edward Post, H. B. Baker. Charles Reed has also passed the Junior Military Aviators' tests.

As these men are well advanced, the next step should be allowing them to train with pursuit machines, but as there are not any available, there have been placed two training machines for them to use on Governor's Island. As in case of trouble they would serve in the Squadrons having charge of the aerial defenses of the city, and the attacking forces would have aeroplanes capable of a speed of close to 120 miles an hour, it is positively necessary that they be given fast machines for training, and that they be taught aerial gunnery, wireless, bomb dropping, aerial photography and spotting of artillery fire. And their number should be increased as fast as possible until we have at least one hundred well trained military aviators and as many military balloon operators for the defenses of New York.

Army and Navy News

First Lieut. Clearton H. Reynolds, Aviation Section, S.O.R.C., is assigned to active duty at Mineola, Long Island, N. Y. (Feb. 21, War D.)

The following promotions and appointments, Aviation Section of the Signal Corps, are announced: To be sergeants first class—Sergts. Earl F. White, James S. Krull, Robert P. Grey, Charles R. Forrest, Stanley V. Coyle, William R. Morrison, Richard H. Greyfield, George F. Faircloth, Albert A. Fletcher, Charles S. Lee, Walter S. Smith, Bert Hart, Harley A. Moore, Joseph Castillo, Newt Frey, Wilburn C. Dodd, Arnold Ruef, Jacob F. Kuhn, Henry Daum, John W. Frewer and James Devitt, to date Feb. 16, 1917, and Pvt. George B. C. Kuster, to date Jan. 22, 1917.

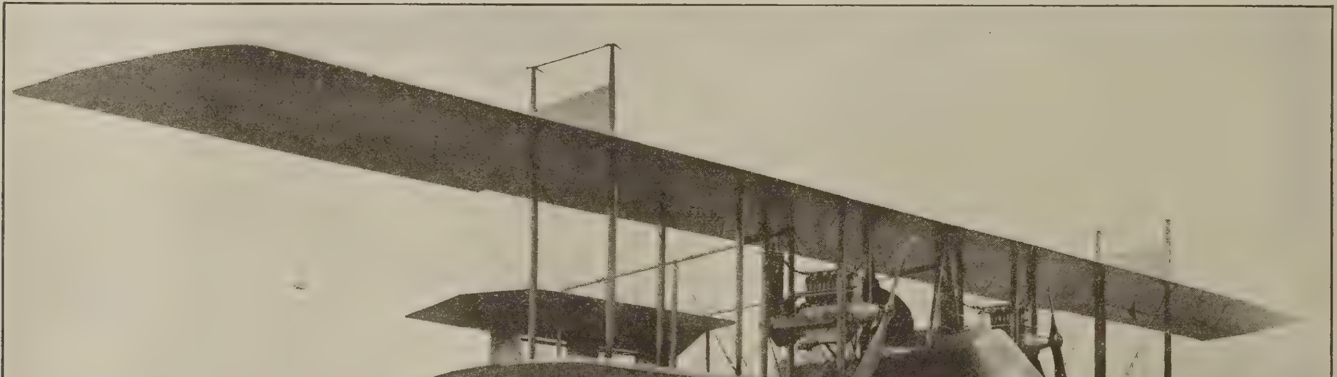
Sergt. James R. Graham, of the Signal Enlistment Reserve Corps, is assigned to active duty in the Aviation Section, Signal Enlisted Reserve Corps, with station at the Curtiss Aviation School, Miami, Fla., Feb. 24, 1917. (Feb. 24, War D.)

Sergt. Samuel B. Eckert, Signal Enlistment Reserve Corps, Fort Monroe, Va., to active duty in the Aviation Section, Signal E.R.C., with station at the Curtiss Aviation School, Newport News, Va., Feb. 26, 1917. (Feb. 26, War D.)

N. Y. AERO CONSTRUCTION CO'S SEAPLANE

The hydroaeroplane recently completed and tested by the N. Y. Aero Construction Co. has a supporting surface of 820 sq. ft., twin Aeromarine motors, 100 h.p. each, and twin pontoons, weighs 2,700 lbs. and has room for a useful load of 1,700 lbs. Its maximum speed is 85 miles per hour, minimum, 43 miles per hour, and has a flying radius of nine hours. Due to advanced type of pontoons and other features embodied in the plane, it rose from the water on test within fifty feet, Aviator W. Leonard Bonney flying. The pontoons can be replaced by land rigging.

The plane was designed and constructed under the supervision of Mr. Warren S. Eaton, who is a pioneer in the aviation business, having designed and constructed planes for the Glenn L. Martin Co. of Los Angeles. He also designed and built four of the most efficient planes for Lincoln Beachey, which had their demonstration before people in the West.



COURSE OF INSTRUCTION FOR STUDENT NAVAL AIRMEN

AERIAL AGE is this week able to present to its readers an outline of the course of instruction for student airmen at the Pensacola, Florida, station.

Upon reporting to the flying school students are divided into sections, each section spending about twelve weeks on shop instruction and about a month on the beach with aeroplanes. When the marks in all shops and on the beach are satisfactory, the student is qualified as an airman.

The terms of the course are as follows:

The time spent in the various departments is as follows:

Erecting Shop............	3 weeks	Multiple 3
Motor Erecting Shop......	3 "	" 2
Carburetors & Magnetos....	1 week	" 1
Joiners, Cooper & Fabric Shops	2 weeks	" 1
Balloons	1 week	" 1
Hangars	4 weeks	" 2

2. Upon becoming qualified airman the required number of Student Quartermasters will be selected, the rest of the qualified airmen will undergo a course of instruction for the rating of machinist (aeronautic).

3. Student Quartermaster will receive instructions in flying and will undergo a theoretical course of instruction in aeronautics.

4. The course of instruction for machinist's (aeronautic) will be published later.

5. Marks on all shops will be on a scale of 5. A mark of three in each and every subject is necessary to pass.

AEROPLANE ERECTION SHOP

Shop Instructor, Lieut. (j.g.) R. D. Kirkpatrick, U. S. N.

Asst. Shop Instructor, Lieut. (j.g.) M. Masek, U. S. N.

Assistant Instructors: H. E. Adams, R. L. Naford, H. J. Knapp, J. Galvin, B. Rhodes.

I.

(a) Names of all parts of aeroplanes.
(b) Kinds of material used in wings, pontoons, propellers, struts, fuselage, etc.
(c) Instruments carried in the different aeroplanes and the purpose of each.
(d) Approximate overall dimensions of the various types of aeroplanes.

II.

(a) Method of assembling
(b) Method of wiring and location of struts.
(c) Method of securing wings to fuselage in different types of aeroplanes.
(d) Method of securing pontoons to planes in different types of aeroplanes.
(e) Method of securing horizontal rudder, vertical rudder, ailerons or wing flaps, vertical fin, and stabilizer of various aeroplanes.

III.

(a) Factor of safety usually required in aeroplane construction for the use of the Navy.
(b) Kind and approximate size and strength of control wires and other wires.
(c) Describe three ways of making a wire terminal and tell which way is most efficient.
(d) The general design of various fittings used, such as wing fittings, strut fittings, ponton fittings, fuselage fittings, control surface fittings, etc.
(e) Which aeroplane used turnbuckles in their wiring and which do not. How may an aeroplane be assembled if no turnbuckles are used?
(f) At what angle are pontoons set relative to wings, and reason for same.

IV.

(a) How are propellers balanced?
(b) How are propellers secured to the various motors.
(c) How are propellers marked and what record is kept of them?
(d) How are aeroplanes marked?

V.

(a) Trace the gas loads from tank to motor in the different aeroplanes.
(b) What method is employed to fight fire in Navy tractors?
(c) Names and general description of the different methods of controlling an aeroplane in flight.
(d) What arrangement is made to control certain aeroplanes on the water?

VI.

In addition to the above general questions on construction and assembly of aircraft, the knowledge of the following with reference to experiments and tests is required:—

(a) Method of testing material with Tinis Olsen Testing Machine and general description of same.
(b) Method of testing material for compression, and description of machine for same.
(c) Method of stretching wire, including description of macine and reason for stretching.
(d) Method of bending wire description of wire bending machine.
(e) Method of finding center of gravity of an aeroplane.

MOTOR ERECTING SHOP

Shop Instructor, Lieut. (j.g.) E. H. McKitterick, U. S. N.

Asst. Shop Instructor, Lieut. (j.g.) L. L. Rabbitt, U. S. N.

Assistant Instructors: W. E. McCaughtry, A. A. Golay, G. Fahy, H. Hansen, S. D. Thornton.

The following motors will be studied: Curtiss OXX 2, Hall-Scott, Thomas and Sturtevant.

I.

(a) Lecture on the principles of the internal combustion engine or gasoline motor.
1. Definition of a motor.
2. Explanation of the term cycle.
3. Two and four cycle motors.

(b) Practical explanation of motor.
1. Function of different parts.
2. General nomenclature.

II.

a) Disassembling of a motor.
1. Steps in disassembling.
2. Detailed nomenclature.
3. Material used in different parts and why?
4. Forms and size of bolts, parts, etc. and reason for same; locking devices and reasons for same.
5. Notes on any worn, cracked, bent, twisted or found weakened part and the reason for this condition and how to correct.

III.

(a) Overhaul of motors.
1. Cleaning of parts.
2. Tests for alignment, as far as cam-shaft, main shaft, face plates, and gear balance.
3. Trace oiling and water systems.
4. Thorough examination of all parts for flaws or worn places as scorings in cylinders, etc.

IV.

(a) Assembling of motor.
1. Spotting in main-shaft.
2. Fitting Cam-shaft.
3. Reaming out wrist-pin bearings.
4. Test main-shaft for balance.
5. Grinding in of valves and testing same.
6. Testing valve springs, exhaust and intake.
7. Fitting thrust block.
8. General assemblage.

(b) Timing of motor and valve setting.
1. Method of adjusting valve clearance and reason for clearances.
2. Method of timing magneto and reasons for advance.

(c) Final adjustments and connections before going to test stand.

V.

(a) Test stand.
1. Connecting up motor.
2. Securing propeller.
3. Data required for motor tests and the requirements for an aeronautic motor.

(b) Motor troubles.
1. Causes.
2. Results.
3. Connections.

(c) Care and upkeep.

CARBURETORS AND MAGNETOS

Shop Instructor, Lieut. (j.g.) H. B. Cecil, U. S. N.

Assist. Shop Instructor, Lieut. (j.g.) C. T. Hull, U. S. N.

Assistant Instructors, S. D. Thornton, R. T. Cupples.

I.

(a) Carburetors.
1. Theory of the carburetor.
2. Theory of the Zenith carburetor.
3. Jets, chokes and their uses.
4. Carburetion troubles and their remedies.

II.

(a) Magnetos.
1. Electrical principles of the magneto.
2. High and low tension magnetos.
3. Dixie principle.
4. Bosch principle.
5. The construction of both magnetos, and the difference between them.
6. Distributor, its construction and use.
7. Magneto circuit.
8. Spark plugs.
9. Coils.
10. Timing and firing order.
11. Magneto troubles and remedies.

JOINER, COPPER AND FABRIC SHOPS

Shop Instructor, Lieut. (j.g.) C. P. Mason, U. S. N.

I.

Joiner Shop.
(a) Nomenclature of parts.
(b) Wings, fins, struts and stabilizers.
1. Contsruction of ribs.
2. Longitudinals.
3. Spars.

(c) Floats.
1. Outside: keel, steps.
2. Inside: bulkheads, frames, supports.
3. Drains.
4. Methods of fastening to aeroplane.
5. Various types.

(*Continued on page 28*)

The Curtiss Seaplane in which Captain Evans of the Aeronautic Station at Pensacola, looped-the-loop on February 14, and in which Lieut. McDonald, U. S. N., duplicated the feat the following day. In the photograph are seen various members of the State Militia detailed for instruction at Pensacola.

MINEOLA AIRMEN HAVE AERIAL MANOEUVRES

Garden City, March 9—Flying under conditions hitherto considered unconquerable, the student aviators of the Government school at Hempstead Plains, L. I., made a remarkable demonstration of their ability to do war work yesterday. Their progress showed that American aviation has taken a long stride forward.

These aviators had to buck against the uncomfortable handicap of nearly a foot of snow on the ground to make rising and landing perilous, yet they met the new conditions in a way that the regular army officers in command admitted they had not expected to see. Two minor accidents occurred. In one a machine turned a somersault just as it left the field when it brushed into a bank of snow. In the other a machine turned over when it ran into an embankment on landing.

That neither accident was due to carelessness was shown by the fact that one mishap came to Capt. Joseph E. Carberry, commandant of the school, and the other to Capt. A. W. Briggs of the British Royal Flying Corps, who came to this country on leave of absence after a long war experience. In both accidents the damage was confined entirely to a broken propeller of the machine.

The work yesterday was not an exhibition, for the school is under military control and the general public is not allowed inside the gates. It was a manœuvre pure and simple, its purpose being partly to test the men in mimic war and partly to determine the possibilities of an aerial attack on the field, on nearby fortifications and even on New York. Similar tests are to be held every few days during the coming year.

Capt. Carberry and the other officers and instructors at the school had been planning the manœuvre for several weeks, but each time it was scheduled rain or heavy fog came to make practical reconnaissance impossible. On Tuesday it was decided to go ahead yesterday regardless of anything but the necessity for a clear sky. The heavy snowstorm threatened to stop the plans, but a crew of mechanics and helpers were at work all Tuesday and yesterday morning shovelling a runway about twenty-five feet wide and 150 yards long near the hangars, from which it was expected the machines could rise.

Everything seemed to go wrong at the start yesterday. In the first place word was sent that a squadron of aeroplanes from Governor's Island, which had been expected to act as the enemy air fleet, would not take part because they could not rise from the snow at their station. It was then decided to use three of the fast L. W. F. machines at the school for this purpose.

So bad was the condition under foot that it was found impossible to get a heavy automobile through the snow to the L. W. F. hangars on the opposite side of the big field from headquarters to carry the pilots to their machines. It was necessary to take them over in aeroplanes. For the first time in history, perhaps, an air machine was called upon to do a job of transportation that a land truck could not handle.

By 3 o'clock things were ready. There are thirty-five machines now at the school, but for lack of sufficiently experienced pilots only eighteen could be used in the manœuvres. All these, however, were out in front of their hangars in the snow, their engines purring like huge cats as they were warmed up for their work.

Soon after a few machines began to go up to "feel out the air." One of the first of them was the Curtiss machine, No. 171, with Capt. Briggs as pilot and Bert Acosta, the former Curtiss instructor, as observer. Capt. Briggs rolled up to the shovelled pathway and then swept along it for the takeoff.

He had gone about 100 yards and was just lifting from the ground when a sudden gust of wind hurled his machine into a mound of snow alongside. The tip of the lower plane caught in the embankment. The biplane, stopped unexpectedly while going at express train speed, somersaulted. Its tail rose in the air and circled down until the machine was bottom up, the two men underneath.

A crowd of students, instructors and mechanics ran to the spot, a squad of them bearing stretchers. By the time they got there Capt. Briggs and Acosta had crawled out from the tangle and were laughingly shaking hands over their escape. The machine suffered a splintered propeller but nothing more.

Thereafter the pilots avoided the shovelled pathway. One of the more daring first discovered that the crust of the snow had softened to such an extent that he could get off right from the field. Thereafter they all did it, although every machine had to be helped out by perspiring machinists until it was ready to start away.

The machines landed on the snow, too. Not one had ever tried it before, and it took unusual skill. It was impossible to volplane down and roll along for a hundred yards in the usual way. The machine had to "pancake" down flat and come to an immediate rest or its momentum would turn it into a nose dive as it struck the snow.

The proceedings were held up for some time by the fact that the enemy could not get up. At last they got away. Leonard Bonney, formerly head of Carranza's Mexican aviation corps and now a Government instructor, had one machine. The two others were piloted by A. Livingston Allan and Harold Blakeley. They had received secret instructions to fly over Oyster Bay and then return by three separate routes, evading the protecting squadron.

After a long period of waiting Capt. Carberry decided to fly over to the L. W. F. hangars himself and see what was wrong. He found the trio ready to start, and to signal the joyous fact he turned a loop the loop in the air on his way home. Unfortunately, however, he landed in a snow embankment and did another loop on the ground that turned his machine upside down with a broken propeller. He himself was not scratched.

As soon as word came that the enemy machines were on their way fifteen protecting biplanes went up. Lined up in single file, one behind the other, they began rising from the snow. At last all were in the air and a few minutes later had reached altitudes ranging from 1,000 feet to 6,800 feet. At the latter height they were invisible and the hum of their motors could not be heard.

It was nearly 6 o'clock before the three enemy planes came home. Allan, flying at the extreme height of 9,600 feet, had come in over Hicksville. He had seen a number of the home air fleet, but came through with only a few of them having been able to distinguish him by the black and white stripes painted on his fuselage. Bonney, flying at 8,200 feet, passed over the cordon and so did Blakeley, who kept lower.

The three biplanes were "spotted" by a number of the pilots, who were instructed to turn in reports in writing this morning. It appeared that it would have been impossible for an aerial enemy to come in undiscovered on a clear day, but the manœuvre demonstrated the need of fast pursuit planes for defence purposes. The pilots admitted that they could never have overtaken the invading machines, although the L. W. F.'s have a speed of but ninety-four miles an hour.

Six of these fast scouts are now being bought for the school for advanced work and will be on hand in a week or so. They will be two Curtiss triplanes, two Thomas battle biplanes and two Sturtevant biplanes. A Curtiss twin motored R-2 biplane is also being assembled in the hangars.

There are now thirty men under instruction at the school and twenty applications a day are being received. Capt. Carberry expects by May 15 to have fifty men in training. The course will take three months, and each month a new class will be started, so that by July there will be 150 students at the field. The school expects to turn out 480 experienced civilian pilots a year capable of military service.

The men who piloted the home squadron yesterday were Capt. Briggs, Lieuts. Ivan P. Wheaton and A. J. Coyle; Sergt. L. V. Smith; Corporals W. P. Willetts, H. H. Salmon and Robert M. Olyphant; Privates Daniel Morse, H. F. Wehrle, Charles Post, Havilock Simon and W. H. Watkins, and Instructors P. C. Millman, Filip Bjorklund and N. J. Norton.

Some of the Army instructors who took part in the air manoeuvres.

THE LEWIS AUTOMATIC MACHINE GUN

THE Lewis machine gun is an air-cooled gas-operated, magazine-fed arm, weighing 26 pounds. It is entirely free from external accessories for cooling, feeding or any other purposes as an automatic pistol. And, except for the difference in size and weight is just as mobile—as quick to get into action, capable of operating in any position, of firing straight up or straight down, or of being fired when turned on either side or upside down.

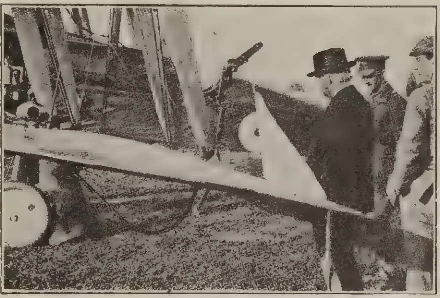
The speed of getting into action and the ability to function automatically in any position are due to the use of detachable drum-shaped rotating magazines. Each magazine holds 47 or 97 cartridges. When a magazine is latched on the magazine-post it temporarily becomes a part of the gun, requiring no further attention until empty, when it is snatched off and another snapped on as quickly as an empty magazine is dropped out of an automatic pistol and a loaded one inserted.

Cooling in the Lewis Gun is by air, but it is an active, positive process. The gun cools itself so that a perfectly safe temperature is maintained even during the most extended periods of automatic fire. The cooling means is incorporated in the design of the gun, and makes no demand on the attention of the operator.

This is accomplished by entirely surrounding the barrel with an aluminum radiator having thick high radial fins extending its entire length. Aluminum is especially suitable for this purpose, not only because of its lightness, but on account of its high thermal conductivity —the speed with which it conducts heat from the hot barrel to the surrounding air. The high fins of the radiator present an enormous radiating surface to the air, but cooling by simple radiation from all this exposed surface is not relied on. Provision is made for ensuring a very strong current of air along the radiating surfaces of the fins from breech to muzzle.

For this purpose the radiator is enclosed in a thin sheet steel casing, open at both ends, and extending well beyond the muzzle of the barrel. The muzzle-blast from firing, properly directed by the barrel-mouthpiece to produce the greatest suction-pump effect on the radiator casing at the muzzle, pulls a column of fresh air through the grooves between the radiator fins each time a shot is fired. So that during automatic fire a steady column of air is being pulled through the radiator at high velocity, carrying off the heat transmitted from the barrel.

The Lewis gun mounted on the Atlantic Aircraft Co.'s trim motored battleplane.



Hon. H. H. Asquith examining gun on British aeroplane.

Power to operate the action is obtained by taking powder-gas from a small port in the barrel near the muzzle into a cylinder under the barrel, where it drives rearward a piston at the front end of the operating rod. This opens the action.

By the opening stroke the breech bolt is unlocked and withdrawn, the fired shell extracted and ejected, a cartridge is carried by the feed-arm from the magazine into feeding position in the receiver, the magazine is rotated and locked, and the mainspring is wound up.

Also, if the trigger is not held back, the sear will engage with its notch in the operating rod, and the gun will remain in the "ready to feed" position with action open and chamber empty.

But if the trigger has been held back, the closing stroke of the action instantly follows the opening stroke. Otherwise, it does not occur until pressure is again applied to the trigger, drawing the sear out of engagament with its notch in the operating rod. The operation of the gun is continuous as long as there are cartridges in the magazine.

Power for the closing stroke is supplied by the mainspring, which rotates the gear and drives the operating rod forward by means of teeth on the surface of the gear wheel meshed with teether under the operating rod, just reversing the motion by which the spring was wound up by the opening stroke. With this closing stroke the breech bolt drives the cartridge in the receiver ahead of it into the chamber, the bolt is cammed around the lock, the extractors taking hold of the rim of the cartridge, the feed arm is returned to its former position at the right, and finally at the end of the stroke the striker hits the primer of the cartridge and fires it. And as soon as the bullet gets beyond the gas port in the barrel the opening stroke commences.

It will be noticed that when pressure on the trigger is relaxed and the gun stops firing it is left with the action open and the chamber empty. This not only still further facilitates cooling, but prevents the unintentional firing of a cartridge in the chamber by heat from the barrel. In other machine guns when firing is stopped before the gun is empty, it will leave a loaded cartridge in the barrel. Unless it is instantly removed, the heat of the barrel will in a few seconds fire this cartridge.

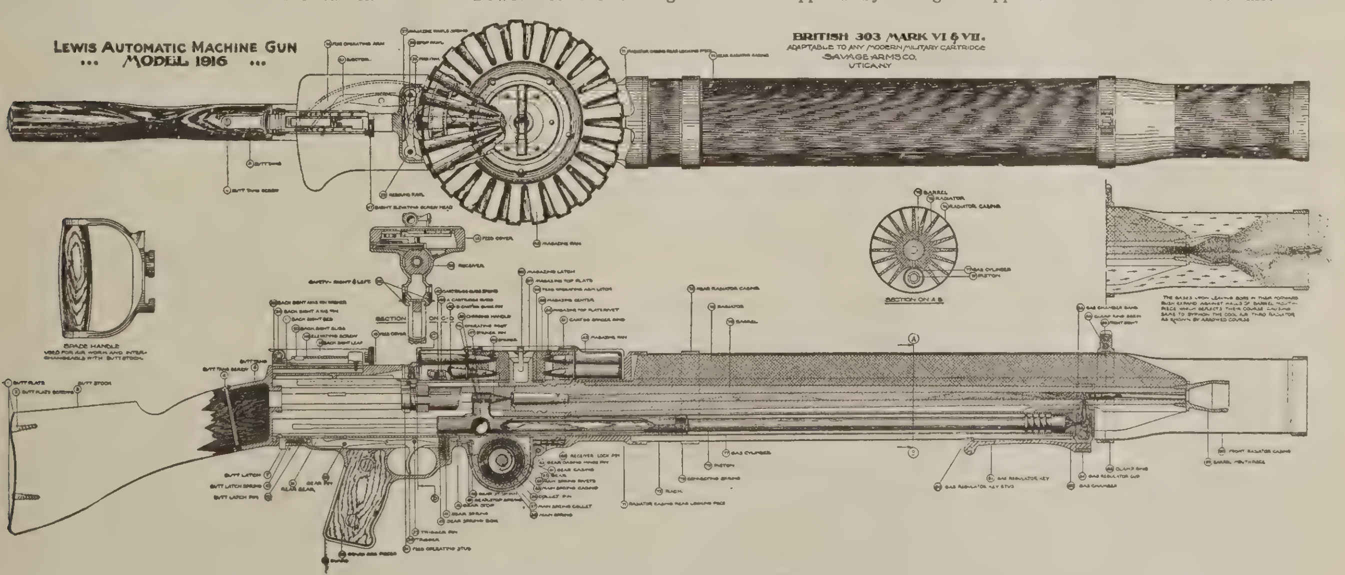
The action of the Lewis is especially attractive to a rifleman. The gun may be entirely dismounted without the use of any tool except a small spanner. The breech bolt rotates to lock and unlock and has four large, substantial locking lugs. This rigid and secure form of breech closure prevents the increased head-space and consequent breakage of shells characteristic of machine gun actions locked by toggle-joints or by locking blocks, and this with modern military cartridges of high concentration, is a matter of vital importance.

A feature of great practical value is the ability of the Lewis to fire single shots on the same line of sight that is used for automatic fire. With other machine guns it is a matter of common knowledge that automatic fire and semi-automatic fire requires different sight adjustments due to the difference in barrel vibration and consequently in flip. In the Lewis the contract and support of the radiator limits and breaks up barrel vibrations, and as a result flip is reduced to a point where it is negligible.

Another interesting feature is that the pull of the powder gases exerted on the front end of the radiator casing counteracts the recoil so effectively that it becomes merely a moderate and steady rearward push. Consequently the gun may be fired offhand from the shoulder if desired, and the necessity of a heavy tripod to secure permanence in alignment during automatic fire is practically obviated. For fixed positions on the defensive some form of tripod is usual but for offensive where mobilty is desired, the 3½ pound field mount has proven perfectly adequate.

It is obvious then that the Lewis may be used with tripods or mountings of any design, and when so mounted the horizontal or vertical angle at which the gun may be fired is restricted solely by the limitations of the tripod.

With the many features described above the Lewis Gun has shown a versatility and sureness of action that makes it equally effective on either the rigid base in land actions or the undulating, fragile supports on water or in the air.



Section diagrams of the Lewis automatic machine gun.

THE GERMAN AEROPLANE ENGINE TRIALS

A Detailed Description of the Equipment and Proceedings

ALTHOUGH these trials were held as long ago as 1913, the following is the first really complete description of the somewhat original testing plant employed. Effort will be made to describe in some detail the results obtained and the conclusions reached by the judges. When it is remembered that prizes to the extent of over $30,000 were awarded, it will be clear that the competition was one of some importance. The notes to follow are based upon a detailed account of the plant, and a complete report of the proceedings, so the information that will be given should be of some value and considerable interest to the many firms who are manufacturing aero engines and also to designers. At the time that the trials were held, few British firms were engaged in the construction of engine for aircraft, and such reports as did appear in our technical press were very brief.

Most readers will be surprised to learn that forty-four actual entries were received, together with twenty-four reserve engines, which could be used if the engine under test suffered from some misfortune not coming within the rules. The result was that over sixty engines had to be tested within a period of ten weeks.

As stated, most of the plant was original, and, further, it had to be adaptable for use with all the different types of competing engines, including rotaries, as well as air and water-cooled stationary motors. Although not specifically stated at the time, it is quite obvious now that one of the chief objects of the competition was to stimulate the production of aero engines for war purposes, and therefore consideration was given to manufacturing points, and as well as to the efficiency of the engines or their suitability for aviation work. However, the chief point to receive consideration on the part of the judges was the total weight of the engine and fuel, etc., for a seven hours' run in relation to the b.h.p.

To arrive at a proper result, it was realized that it would be useless to ascertain the b.h.p. by the usual brake methods, because the propeller, normally in use, serves as a flywheel, and yet it would not be correct to substitute for it a flywheel. It was not, however, considered practical to obtain the required figures from the thrust developed by a propeller supplied with the engine, as there were many different types of propeller available, and such a test would have resulted in the production of a number of freak air screws just as the Prince Henry motor car trials produced freak cars.

It was finally decided to fit to each engine a standard propeller designed for the power and type of engine under test, and to arrive at the horsepower by ascertaining the torque reaction. For this purpose the engine was mounted upon a cradle which could rock, and the rocking tendency, or torque reaction, was measured. From the figures so obtained the power was ascertained.

In the case of rotary engines some allowance had to be made for the churning of the air by the engine cylinders, because this in itself creates a torque reaction which obviously is of no value when calculating horsepower. It was decided not to take into consideration the head resistance of the engine, as this point was largely affected by the method of mounting the engine on the aeroplane, and, although one engine might be better than another in this respect, it is clear that this point had to be ignored. Unfortunately, for some reasons, the water-cooled engines were not tested with their own radiators, because here again was an opening for the production of a "freak," and, after all, the radiator is not so intimately connected with the engine as is the carbureter or the ignition apparatus. Furthermore, the radiator is not, as a rule, made by the engine manufacturer, but is the product of a separate specialist, and therefore in a test of this kind it was decided not to handicap the engine maker for a possible fault on the part of the radiator manufacturer. It may be well to mention that the weight of the radiator should be added to the weight of the engine in order to arrive at the mass of the whole plant, and that it was found the radiator weight ought to be estimated on a basis of .389 pounds per 1,000 b.t.u. This figure should be used to ascertain the total plant weight. This figure includes water tanks and connecting pipes. During the test the entering water was maintained at 70° C.

A point which will strike the casual reader is the complication of the test plant, and one may well inquire why simpler plants could not be used, such as those employed nowadays by every maker of aeroplane engines. It must therefore be made clear that there is a big difference between these trials, which were competitive, and the ordinary tests made by a manufacturer. The necessity of employing a propeller of some kind has already been mentioned, and the presence of this prevented the power being ascertaind by electrical or other means. The chief point is, therefore, that to compare one engine with another it was essential to make the conditions of the trial approach as closely as possible to those which would obtain when the engines are in normal use. The manufacturer, however, merely wishes to know that each engine will produce certain figures on his testing instruments. If he wishes to compare one engine with another, his test must be made very much finer, and if he deems it essential to fit a propeller, and not a flywheel, during his tests, then he must employ some such plant as that which was used in these trials. Another point was that one of the aims of the trials was to ascertain the reliability of the engines under flying conditions, from which it will be clear that the use of a propeller was essential. Therefore, each competitor had to send in his engine fitted with a propeller, which was calibrated and measured up during the trials.

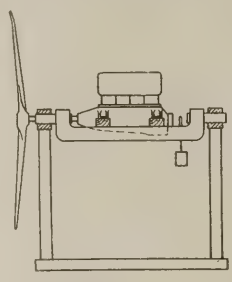


Fig. 1

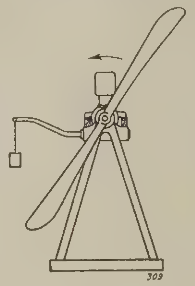


Fig. 2

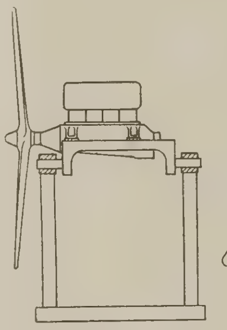


Fig. 3

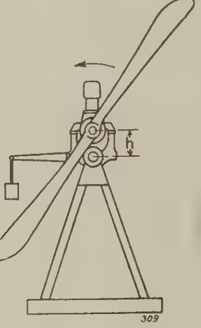


Fig. 4

Briefly, the testing plant comprised a cradle upon which the engine was mounted and which could rock, tending under the torque reaction to turn in a direction opposite to the propeller rotation. This tendency was balanced by weights placed upon a scale pan, and, by means of the weights or by using a pressure gauge acted upon by the balance beam, the output of the engine could be ascertained.

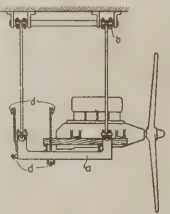


Fig. 5

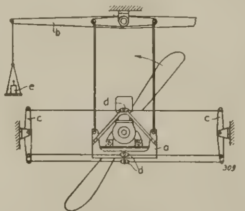


Fig. 6

To gauge the propeller of each engine—which was necessary, as they and their speed of revolution varied—it was essential to employ a special electric motor with a long shaft, which normally was disconnected from the propeller. For this test, the propeller could be disconnected from the crankshaft and fitted to the end of the motor shaft and the electric motor set running. This instrument was of a special type, as the power output could instantly be measured by ascertaining the reaction of the housing, which was quicker and more accurate than measuring the current consumption and making allowances for loss of efficiency.

Another condition of the trials was that the motor should be run under test in tilted as well as horizontal positions, and therefore the cradle was suspended so that it could be inclined, as shown in Fig. 5, through an angle of 25°. By this means it was possible to test the engine under conditions of ascent and descent. It was also essential that the engine should be capable of running slowly and of rapid acceleration both in a horizontal and an inclined position. It was a further condition that the engine should be tested for its flexibility up to its maximum speed.

In the case of air-cooled engines a special fan was provided to supply an air draught, which is shown at *n* in Fig. 14. This was mounted upon a sleeve through which passed shaft *l*, and it was driven through a belt from a second electric motor *m*.

It was realized that, in spite of the somewhat elaborate test plant, the exact conditions could not be reproduced, because on an aeroplane the engine is traveling through the air, and it is almost impossible to reproduce this feature in a test shop. Further, a test bench, even with a rocking cradle such as that used in these tests, is obviously more rigid than an aeroplane fuselage, and therefore vibration effects were not noticeable during the trials. It had been suggested that the engine be tested on a whirling table comprising a long arm rotating about a center, so that the trial could be made with the engine in motion, but this was deemed wholly impracticable owing to the very high speed of revolution which would be necessary to approximate to flying speeds; and, again, because the engine would continually be traveling in its own wake, and the air would be too much disturbed by it and by the apparatus upon which it was mounted. If it were essential that the engine should be tested traveling through the air, it would be ridiculous to carry out a trial in which the engine was continuously moving through air which it has passed through. Unfortunately, aerial disturbances cannot be seen, and therefore there is a tendency to use whirling tables and so forth for tests.

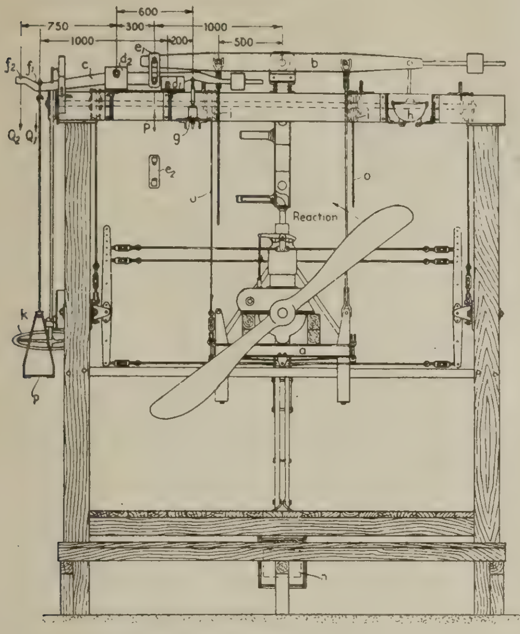
It is suggested that results obtained in this way are of little or no use. In testing hull forms in ship designs, it is not the custom to use circular movements, although in such a case it is possible to eliminate disturbances due to the arm by supporting this out of the water, but there still remains the wake behind the model being tested, which creates a disturbance of the water lasting for a considerable time. For the same reason it was considered quite impossible to employ any reasonable form of moving test bench in these trials, but the engines were run in air currents of various directions.

The Test Plant

As will be gathered from the introductory notes, the major portion of the test plant had to be specially provided, as there was nothing in use sufficiently elaborate to test engines according to the conditions. At the Zeppelin works at Friedrichshaven the Maybach engines are tested on a swivelling cradle, which is illustrated in Figs. 1 and 2, and although this bench can be used satisfactorily for these particular engines, it could not be employed for the competing engines.

It will be noticed that the crankshaft in Fig. 1 projects very considerably to the left and that the propeller is mounted beyond the trunnion. This correct coaxial arrangement is quite practicable in the case of airship engines, because the crankshaft normally projects in this way, being connected by gearing with the propellers; but with aeroplane engines there is little or no crankshaft projection, and the propeller is mounted very close up to the front of the crankcase. To use a rocking cradle of this kind would mean providing special extensions for the crankshafts of all the engines, and this in turn would introduce complications due to whip and vibration, which would probably necessitate special bearings and other constructional features. As the idea of these trials was to test standard engines, it was obvious that the judges could not reasonably expect manufacturers to make special provision to suit their testing plant.

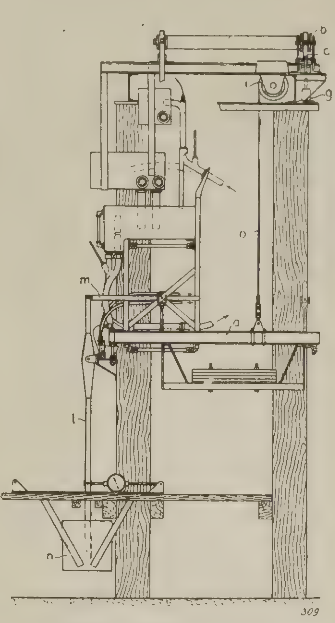
In Figs. 3 and 4 is shown an alternative suggestion, in which the trunnion for the cradle is eccentric to the axis of the crankshaft, the eccentricity being indicated by the height *h*. This arrangement is sometimes used, but it was discarded, as it introduces inaccuracy owing to the fact that the resistance to the travel of a propeller blade may be different during the upper half of the revolution from what it is during the lower half, in consequence of the interference created by the legs of the stand. This type of



Right-hand propeller.

$$P = Q_1 \frac{1000}{100} = 10\ Q_1$$

$$P = p\,l \frac{200}{100} = 2\,p\,l.$$



Left-hand propeller.

$$P = Q_2 \frac{750}{300} = 2{\cdot}5\ Q_2$$

$$P = p\,l \frac{600}{300} = 2\,p\,l.$$

With indicator No. 1 of piston area 10 sq. centimetres P in kilos or torque reaction in metre kilos = 20 p.
With indicator No. 2 of piston area 5 sq. centimetres P in kilos or torque reaction in metre kilos = 10 p.
With indicator No. 3 of piston area 2·5 sq. centimetres P in kilos or torque reaction in metre kilos = 5 p.
P and Q in kilogrammes.
p in kilogrammes per square centimetre.
P acts upon a beam l of a length of one metre. Therefore the torque reaction in metre kilogrammes is equal to P in kilogrammes.

Fig. 7

Fig. 8

rocking cradle incidentally is, or was, used by the Automobile Club of France in connection with certain aerial engine competitions.

A point to be noted in connection with these trials is the great care exercised in selecting and constructing the testing plant to avoid any possibility of error.

The authorities finally arrived at a type of rocking cradle that appeared to comply with all requirements, and this is illustrated separately in Figs. 5 and 6, and in position in the testing shop in Figs. 7 and 8. The cradle *a* upon which the engine was mounted was slung by a pair of suspension rods from horizontal rockers so arranged that the cradle could rock round the crankshaft axis. It will be seen from Fig. 5 that this arrangement did not interfere in any way with the position of the propeller. In addition to oscillation about the crankshaft axis, a cradle of this kind can obviously swing (pendulum fashion) about its suspension if no provision be made to prevent it. This swivelling clearly had to be prevented, and to cope with this rockers *c* were fixed to each side of the cradle and were coupled by wires, with the points d on the cradle. Two sets of wires were used, and these were arranged at the end of the engine remote from the propeller, in order not to interfere with the engine or any of its accessories. This cradle was therefore capable of rocking about the crankshaft axis, and it could also move slightly longitudinally in order to measure the thrust of the propeller. The suspension rods were therefore universally jointed to allow of these two movements. For measuring the thrust of the propeller, or alternatively the head resistance of the engine, when the propeller was driven by the electric motor the fork *m* was pivotally connected with the cradle and was coupled to the lever *l*, the lower end of which entered a dashpot *n* (see Fig. 8). The lever was fitted with a plate working in the dashpot, and was coupled to a spring balance or some other form of indicator, which is also clearly visible in Fig. 8.

To tilt the engine in order to make tests under conditions similar to those which exist when rising or descending rapidly, the front suspension rods were removed and the cradle supported by the two cables *o*, which pass round the pulleys *i* (Figs. 7 and 8). These pulleys were fixed on a shaft that could be rotated from a hand wheel *k* through worm and worm wheel gearing, so that by rotating this hand wheel the engine could be tilted through an angle of 10° above the horizontal and 15° below. The rockers and cross connections employed to prevent swinging of the cradle had to allow this tilting movement, and also had to be flexibly or universally mounted. The front pair were suspended by similar cables to follow the tilting movement.

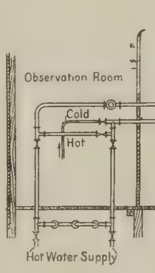


Fig. 9

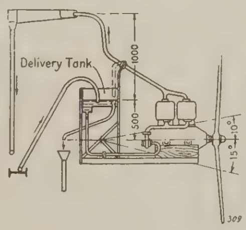


Fig. 10

The method adopted for indicating the torque reaction is shown in Figs. 7 and 8. The suspension rods are slung from a beam *b*, which rocks parallel with the cradle; this beam is interconnected with the second beam *c*, and upon the end of this are slung, from the points f_1, f_2, a pan *p* carrying weights. At *g* is a pressure indicator with an area of piston measuring 10, 5, or 2.5 square centimeters.

If Fig. 14 be examined, it will be seen that in one corner of the test shop is an observation room. In this room were stationed observers, who had before them rows of recording and gauging devices, one of which was connected with the indicator *g* (see Figs. 7 and 8). Where possible every indicating device was duplicated, so that the observers could take readings in comparative comfort, cut off from the noise of the engine, whilst on the test bench were alternative indicators, by means of which the readings in the observation room could be checked. In the opposite corner to the test room was a visitors' room, to which the manufacturer of the engine had access, and his engineers could make private observations.

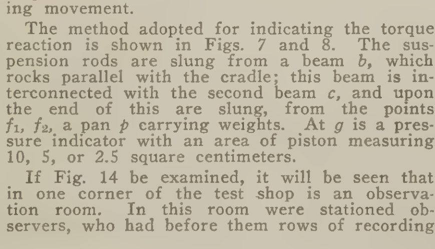


Fig. 11

Returning to Fig. 7, it should be noted that the beam and balancing mechanism there shown was designed so that it could be used both with right or left-hand engines by merely interchanging the knife edge supports d_1 and d_2 and by altering the connection e_1 and e_2 between the two beams. In the one case the connection was in tension, and in the other case it would be in compression. The apparatus was designed to work in both directions with only a small amount of alteration and without affecting the scale of the recording instruments.

Behind the cradle there is a cross beam with stops, which limit the rocking of the cradle; the cross beam also serves to carry petrol and oil piping.

The water tank is carried on the cradle (see Fig. 10). It was continuously fed with water from the mains, and there was an overflow pipe so placed that there was always a water head of half a meter above the crankshaft axis. At low speeds the pumps on most of the engines were not powerful enough to force the water up to the proper high level tank, and therefore the lower tank was used, and the water was delivered to this through the pipe shown in dotted lines. During long tests at high speeds the upper outlet pipe was raised, giving the stipulated head of water. As the water pipes and the tank on the cradle were capable of rocking, special provision had to be made when connecting up these pipes with the rigid tanks, etc.

As the trials took place during the coldest winter months, it was necessary to heat the observers' room, and for this purpose hot water from the engine was circulated through the observation room, and it was also possible to supply hot water from a distant source to maintain the temperature of the water entering the jacket at 70° C. It will be seen from Fig. 9 that various control devices for this purpose were provided in the observers' room. The hot water leaving the engine, as it flowed through the observers' room, was measured and its temperature recorded. Its temperature was then reduced to 70° C. and then returned to the engine.

The fuel supply and measuring apparatus is shown in Fig. 11. The petrol tank *a* was mounted upon a scale, under cover, outside the test shop. The tank and its contents weighed about 400 kilogrammes, and connected with the beam of the scale an electric indicator was arranged in the observation room, which showed each time the beam passed the horizontal. The weights in the scale pan were of 500 grammes each, and after each signal by the indicator one was removed and the time noted before the next signal was made by the indicator. In this the time taken to consume each five kilos of fuel was recorded.

The petrol was supplied to the carbureter through a filter tank *f*, pressure (equivalent to a head of two meters above the crankshaft) being supplied to the tank *a* from a cylinder *c* of nitrogen, a branch communicating with a mercury pot *d* which served as a safety valve. The fuel was also supplied to a graduated glass chamber e, adapted to hold exactly one liter. This one-liter flask was used during short running tests, and also was employed by the engine makers when tuning up their engines prior to the competition. When the one-liter chamber *e* was employed, the two-meter head of fuel was maintained by closing the supply cock *b*, while the vent cock *i* was also closed. The nitrogen from the cylinder *c* forced its way through the standpipe *g*, maintaining the correct head of pressure. It should be mentioned that the petrol level could be seen from the observers' room.

Lubricating oil was supplied to the engine from a tank fixed on the side of the plant. This tank contained a known quantity of oil, and the loss during running was measured by subtraction.

The indicator at *g* (Fig. 7) consisted of a piston acting in a cylinder filled with oil which was connected by a pipe with a pressure recorder in the observation room, so that the observers could continuously ascertain the torque reaction. By emptying the pipe, and placing weights upon the pan hanging from the point f_1 or f_2 on the beam (see Fig. 7), the reading in the observers' room could be checked.

The engine drove a number of revolution indicators and a speed counter. The amount of cooling water was measured by a water meter, and two registering mercury distant thermometers were employed to record in the observers' room the temperature of the water entering and leaving the engine, and, furthermore, on the actual water pipes themselves were fitted thermometers so that the indications of the distant

(Continued on page 28)

THE 1916 TYPE RUMPLER BIPLANE

IT is notable that the majority of German machines captured by the French during 1916 were Rumplers, signifying that the Germans used them in large numbers and that the Rumpler factory is well organized for output. In the French technical paper, *L'Aerophile*, the latest Rumpler biplane was most completely described and illustrated by photographs and drawings, some of which we reproduce.

Herr Rumpler has paid considerable attention to detail design, both in the system of attachment of fittings, the facility of mounting and dismounting parts, and to such things as gun fittings and the comfort of the crews.

A list of general characteristics follows:

General Dimensions

Span, upper plane	12.25 metres
Span, lower plane	11 metres
Chord	1.75-1.62 metres
Wing surface	35.5 sq. metres
Gap	1.76 metres
Length over all	7.90 metres
Height over all	3.20 metres
Weight, empty	830 kgs.
Useful load	433 kgs.
Motor, Mercedes	165 h.p.

Planes

Next the fuselage the wings have an angle of incidence of 5°. The wing section tapers from the butt of the wing to the tip, and their maximum thickness is 92 mm.

Upper planes have a dihedral angle of 2°, the outer forward interplane strut being 160 mm. higher than the corresponding point on the spar at the centre of the machine. There is no stagger, the struts being vertical.

Gap between wings, 1.765 metres. Total surface of upper plane, 19.36 sq. metres. Lower plane, 16.15 sq. metres. Total plane surface approximately 35.5 sq. metres, including ailerons but not the tail plane. In plan the wings taper, the chord being 1.75 metres close to the fuselage, and tapering to 1.62 metres.

Ailerons on the upper planes are attached to subsidiary spars and not the rear main wing spars. They are operated by a lever projecting forward from their leading edges, with a slot provided in the main plane for their movement. An upward movement of the aileron is produced by the cable attached to the lever, and a downward movement by a cable attached near the trailing edge of the aileron.

Fuselage

In the forward part of the fuselage structure, steel tube is used. The motor is carried on ash engine bearers held on steel tubes, these themselves being fixed on the summit of the rear struts of the landing carriage.

The four main longerons from the nose of machine to behind the passenger's seat for a distance of 3.5 metres are of ash, wound spirally with fabric, and behind this they are made of spruce, but not wrapped, which is contrary to the custom of other German makers.

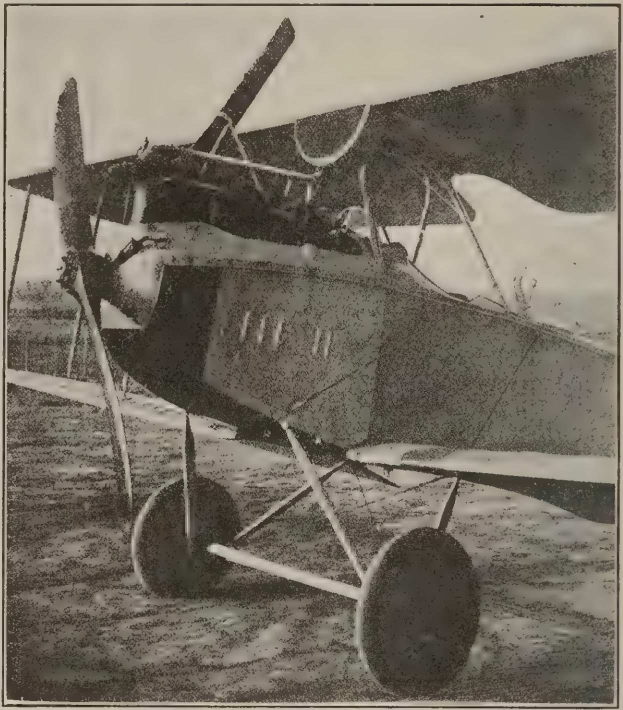
The forward ash sections of the longerons measure 40 mm. by 30 mm., and the after spruce portions, 20 by 20 mm.

The pilot's seat is in the forward cockpit, resting upon the main fuel tank. The observer-gunner is in the rear cockpit, with a seat and gun arranged to turn about on a circular track. In bombing machines release gear is provided for six bombs, with a light gun for defense only. The "destroyers" are equipped with more powerful guns.

Instruments in the forward cockpit are: revolution indicator, magneto switch, starting magneto, ignition advance and retard, pressure indicator for main tank, brake handle, pressure pumps. The compass is placed inverted under the upper right wing.

Landing Gear

Main struts of the landing chassis are of streamline steel tubing, 95 by 30 mm. section. The wheel track is 1.95 metres, and the wheels take tires 810 by 125 mm. Wheels weigh 11 kgs.



Three-quarter front view of the 1916 Rumpler.

A brake for landing is attached to the centre of the axle, operated by a cable to the forward cockpit. Its principle of action in bringing the machine to a stop after alighting is plowlike.

Tail Group

The stabilizing plane is divided, and is set at a slight angle of incidence. The span of the tail plane is 3.38 metres. The tail fin is triangular in shape, 1.12 metres long and 0.82 metres deep, the rudder standing up to a total height of 1.12 metres from the bottom of the fuselage.

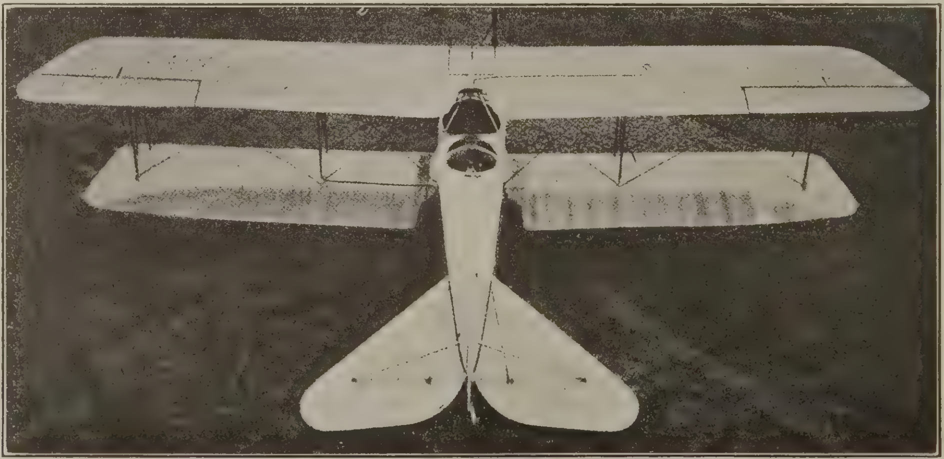
The stabilizing plane has a surface of 2.25 sq. metres. Elevators, 1.70 sq. metres. Fin, 0.45 sq. metres. Rudder, 0.68 sq. metres.

The framework of the tail group is almost entirely of steel tubes. Outer edge of the tail plane is supported about half way along its length by two tubes from the lower fuselage longerons, and at the rear extremity, where it forms the hinges for the elevator flaps, it is held by two other tubes to the rudder post, which also forms the rear edge of the vertical fin.

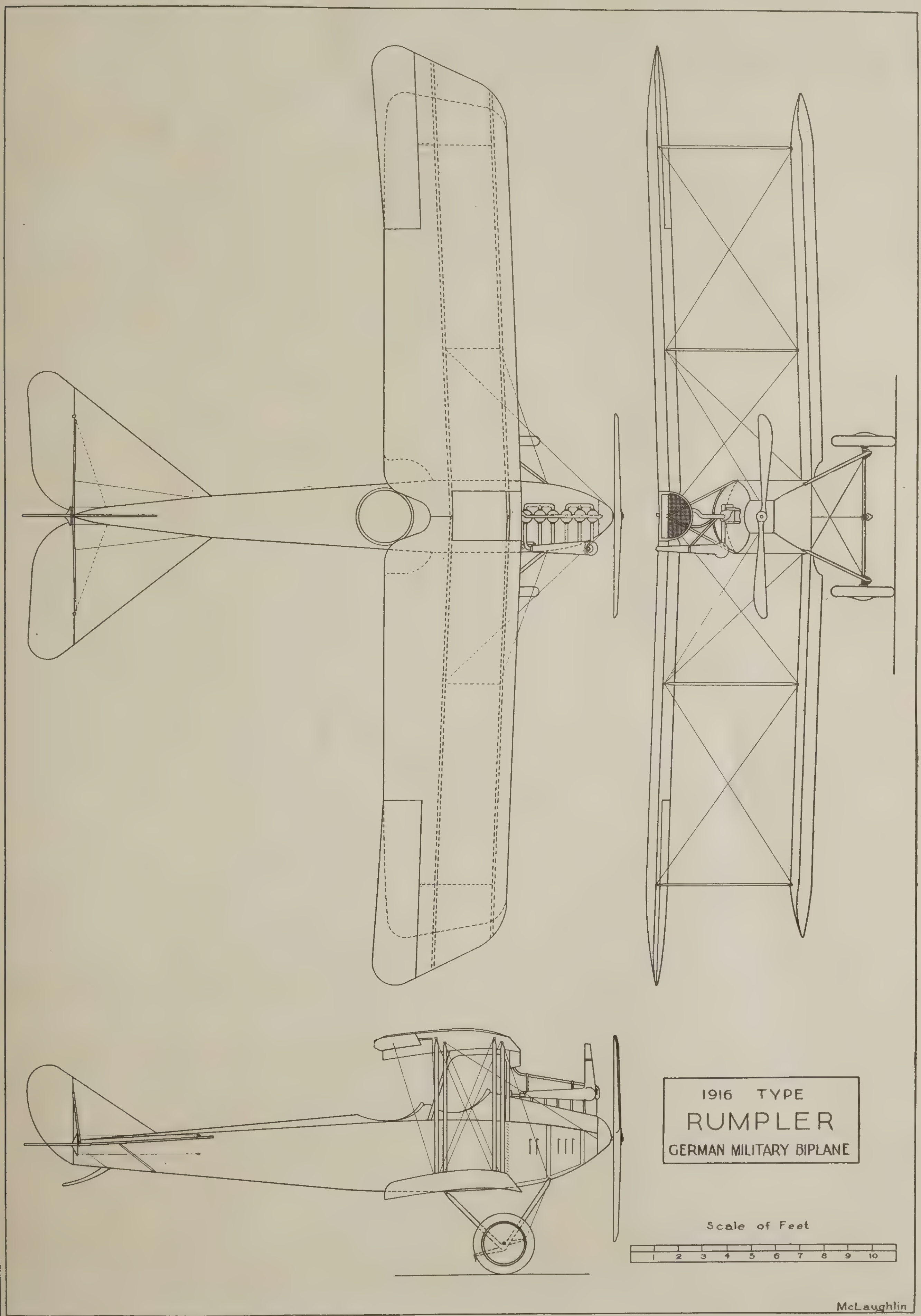
Motor Group

The motor is a Mercedes, and test of two captured machines showed them as giving between 166 H.P. at 1400 r.p.m.,

(*Continued on page* 28)



View of the Rumpler from above, showing the general outline.



1916 TYPE
RUMPLER
GERMAN MILITARY BIPLANE

THE TRAINING IN MILITARY AVIATION

(Lecture by General W. S. BRANCKER, R. A., Director of British Air Organization, before the Aeronautical Society of Great Britian)

THE question of training in aviation is very controversial, and I hope that the many gentlemen here with opinions of their own will help me out at the end of the lecture by airing their opinions and freely criticising anything I say with which they do not agree. I hope to hear the Naval views, the ideas of the newly fledged pilot and pupil under instruction, and the opinions of designers and constructors. Although I have had a great deal to do with the training of pilots since I started work in the Royal Flying Corps, I do not feel very well qualified to speak on the subject, as most of my experience has been on the administration side and not in actual teaching; but I have the advantage of being able to go round visiting aerodromes and hearing a vast number of conflicting opinions. In spite of this I still feel very ignorant on the subject, and have come to only two very definite conclusions. One is that we have a very great deal to learn still regarding the best methods of training pilots, and the other is that it is almost impossible to make any two experienced aviators agree on any one point in connection with aviation.

PILOTS ARE CONSERVATIVE

Another interesting point is that the average pilot is intensely conservative and usually self-opinionated, and so thinks that the methods he is being brought up to must be the best, and hates an innovation like poison. The training of all young animals has been a subject of great interest to me from my youth up, and the training of pilots is rendered still more interesting by the fact that a mistake may mean a bad smash or death.

I think the best way to deal with the subject will be by describing to you our system of training in the days before the War, and the development of this system since the beginning of the War up to the present time. I will then discuss the various accessories necessary for the training of pilots, such as aerodromes, instructors and equipment. After this I will talk of the various methods adopted, and of possible improvements, and wind up by asking some of those present to add their quota.

TRAINING ORGANIZATION IN PEACE

Private Schools | Various sources with no training

Central Flying School

Service Squadrons | Reserve

The first diagram shown represents the organization for training which existed at the beginning of the War. Both Services depended almost entirely on the Central Flying School for the training of their pilots.

In the Army, as a rule, officers who wished to join the Royal Flying Corps called on to take the Aero Club's certificate at their own expense before being accepted. This certificate demanded a very low standard of efficiency, with the result that it was not of very much practical value, and many instructors at the Central Flying School preferred pupils who had not been instructed at a private school before. This was not altogether the fault of the private school, but rather because the gratuity which the Government allowed an officer who was accepted for the Royal Flying Corps and had taken his ticket at his own expense was not sufficiently large to ensure any very thorough training, and the standard demanded by the certificate was so low that I believe pupils often qualified after about two hours in the air.

CENTRAL FLYING SCHOOL

The Central Flying School, on the other hand, probably provided better instruction in aviation than any other similar institution in the world. The course lasted for three months, but it was always recognized that for really satisfactory results this should be extended to about six.

This was never possible, however, as the size of the school was governed by the money available and itself governed the output of pilots, and the output of pilots even in peace from this establishment was not equal to the demands of the two services. During peace, aviation was such a novel proposition that most of the training took the form of flying pure and simple. Military subjects were taught to some extent on the ground, but in the air, as was only natural, the art of handling the machine, of landing it, and of finding the way across country was all that mattered. In those days, bomb dropping, photography, wireless, and fighting in the air were scarcely mentioned. The school was divided up into several Flights, and the training was progressive through these Flights. Almost all pupils started in the Maurice Farman Flight with a period of dual control instruction. They then had a spell of solo work on the Maurice Farman, including a few short cross-country flights. From that they were moved to one of the advanced Flights and were given dual control instruction either on Avros or B. E. 2's, and so on to solo on either one of these types. A particularly promising pupil usually had the opportunity of flying two or three other types of machines before he left the school. The final test was a cross-country flight, at which a height of about 3,000 feet had to be reached, and a spiral landing with engine stopped at its conclusion. Reconnaissance height in those days was considered to be 3,500 to 4,000 feet, and it was only the exceptional pupil that reached anything higher. To sum up, the art of flying was taught as well as it possibly could be, whereas the military side of aviation, as it is understood to-day, was not really included. The school not being large enough to fill the requirements of both services, a certain proportion of officers who had taken their tickets were sent direct to squadrons for training in the early stages.

On the declaration of war all our available resources were sent straight into the field, and the only unit left intact so far as the Army was concerned was the Central Flying School, and even that was severely denuded both of instructors and of aeroplanes which were taken to bring the Service Squadrons up to their fighting strength. Then came a very lean period in England, during which very few pilots were produced, for the simple reason that neither sufficient instructional aeroplanes or instructors were available. It became necessary to formulate some sort of policy. It was obvious that if the war went on for any time we should want a great many more squadrons in the field, and the output of the Central Flying School in pilots could not possibly be sufficient for the replacement of wastage of the squadrons already in the field and the formation of the new ones. New Squadrons, Reserve Service, were therefore started at all existing stations as officers and material became available, and the question arose as to whether these existing stations should be extended to take a considerably larger number of squadrons in the future or whether new stations should be started in various parts of England.

NEW AERODROMES

The latter policy was decided on for two reasons. First, it seemed likely that the best and most economical number of pupils, given unlimited aeroplanes which could be trained on one aerodrome without undue delay and congestion, would be about 60. The number of pupils it was thought that one Reserve Squadron could properly train averaged between 20 and 30, and it was therefore considered that the ideal station should accommodate from two or three Squadrons, either Reserve or Service. The second reason was that it seemed a pity to have all one's eggs in the same basket. The wonderful English climate varies enormously in different parts of this comparatively small country, with the result that whilst the weather was hopeless in London, the Midlands might be perfect, Yorkshire might be impossible, while flying was in full progress in Scotland; it therefore seemed sound to scatter these aerodromes as much as possible. An additional advantage of this scattered disposition was that the new aerodromes would form halting places for new machines being brought down from the contractors, and that this system would also ensure, so far as possible, that all parts of the new Army training in England would see and have some knowledge of aviation. The disadvantages of this system were that the available talent in instructors was scattered instead of concentrated, and probably more instructors were required for a given number of pupils.

After two or three months of war the system was as follows:

The Central Flying School was turning out pilots who were usually absorbed in replacing casualties abroad. There were a certain number of Reserve Squadrons at different stations in England from which Service Squadrons were built up and broken off as they were completed.

Generally speaking, the Service Squadrons carried out the preliminary training of pupils on Maurice Farmans only; these pupils as they qualified were sent on either to the Central Flying School or to a Service Squadron, where they completed their training.

At first, the Central Flying School was equal to the demands made on it by the Expeditionary Force to replace wastage, but as the wastage increased new Service Squadrons at home also had to produce their quota of trained pilots for the Expeditionary Force. The progress of these new squadrons was therefore governed by two factors. First, the output of material on which to train their pilots; and, secondly, the rate at which some portion of their trained pilots was taken away to replace wastage in the field, and eventually as resources became available we had to start Reserve Squadrons to carry out advanced training as well as preliminary.

At this period our two great difficulties were:

(1) A shortage of competent instructors;

(2) Scarcity of aeroplanes and engines;

and we had a very hard struggle to make both ends meet during the winter of 1914-1915, after which matters began to very slowly improve. At the same time the experience of war taught us that a pilot required many qualifications besides those of flying pure and simple.

First, wireless, photography and bomb dropping all came into vogue and demanded extra training. A little later, fighting in the air started, and this involved instruction in aerial gymnastics and the use of machine guns. In the latter half of 1915 fighting in the air became a really serious proposition, and consequently the wastage grew much larger, so much so that during the winter of 1915-1916 the training of pilots had to be considerably forced and hastened in order to keep up with the demands, and the output of new squadrons had to be considerably delayed in order to get training on to a more thorough basis.

The system I have described has been steadily developed until it has reached the organization depicted on the second diagram.

PRESENT TRAINING ORGANIZATION

Observers from France | Civilians, N.C.O.'s and Men recommended for Commissions Cadet Wing | Commissioned Ranks in Army at Home and Abroad

Training Schools
Reserve Squadrons
(Preliminary Training)

Reserve Squadrons
(Advanced Training)

*Service Squadrons | Central Flying Schools

*Service Squadrons

**Includes a Course at the Aerial Gunnery School.*

THE AVIATOR'S TRAINING

Now I will take the career of a civilian who wishes to join the Royal Flying Corps now. He first has to join the Service as a cadet and go through a course in the Cadets' School, at which military subjects, pure and simple, are taught. He gets a grounding of drill and discipline, care of arms, interior economy, military law, and the use of the machine gun; this course lasts about two months. From this the cadet is sent to a Flying Corps Training School, School of Military Aeronautics, where he begins his technical training on the ground. He goes through a course in the care of engines and rigging. He is given some ideas of the theory of flight. He is taught wireless signalling and receiving. He gets instruction in the care of machine guns, in the use of the camera, in map reading, in the observation of artillery fire with models, and in his spare moments he gets a certain amount of drill. This course lasts another two months, and if he gets through this successfully he is given a commission on the General List. He then joins a preliminary training squadron as a pupil and starts his instruction usually on the Maurice Farman, his training both in military and technical subjects going on concurrently. After reaching a certain standard of efficiency and having completed a certain number of hours in the air, he is sent on to an advanced training squadron or Service squadron, where he learns to fly Service types of machines for military purposes, and eventually qualifies for his wings. He is then gazetted as a Flying Officer of the Royal Flying Corps and posted to a Service Squadron. If he shows exceptional promise as a pilot after his qualification he is sent to the Central Flying School, where he is given extra higher instruction on fighting scouts. During the period of advanced training he goes through a course of aerial gunnery away from his squadron. The total time in the air usually required to reach the qualification stage is about thirty hours' solo in present circumstances, but of course the length of time that it takes to reach this standard depends entirely on the weather and the number of aeroplanes available. During the winter it works out to about four months, but in the summer it is considerably shorter.

THE PILOT'S QUALIFICATIONS

The way in which war has forced a higher standard on us is remarkable. Only two and a half years ago, a pilot who flew across country at 3,500 feet and landed without breaking anything was considered to be quite useful. Now the expert pilot has to be prepared to fly at the greatest height his machine will reach, which is sometimes about 17,000 feet, has to dive and loop and side-slip to enable him to be an efficient fighter, and has to have considerable experience in photography from the air, in the observation of artillery fire and the transmission of the results by wireless to the ground, and in the use of the machine gun.

In addition, he must be an expert bomb dropper, which needs considerable practice and experience, and finally in bombing raids, long reconnaissances, and in fighting patrols, it is necessary for aeroplanes to fly in a fixed formation in numbers from two up to twenty, an operation demanding a great deal of skill and experience in the pilot.

There is only one point which has simplified training during this two and a half years: the modern designed aeroplane and the latest engine make flying pure and simple much easier than it used to be. Aeroplanes are usually comparatively stable, and engines have a considerable reserve of power and are far more reliable than in the old days, and these two factors have helped us a good deal in the training of pilots.

To sum up, before the war flying was comparatively difficult, and was the chief factor in the pilot's training, military qualifications being considered of quite secondary importance. Now, flying up to a certain standard is extraordinarily easy, but the standard of military qualifications required is getting higher and higher and more difficult to attain, and at the same time the quality of flying demanded is growing greater every day. So our task at home grows harder.

No Perfect Aerodrome

Now I will just consider the requirements of training on a large scale. First, Aerodromes. There is no such thing as a perfect aerodrome, and even a possible one is very difficult to find in England without either interfering with somebody else's rights or involving an enormous amount of labor and consequent waste of time. Personally, I believe that climatic conditions and a sound soil are the two most important factors when selecting an aerodrome. In England, however, climatic conditions are so varied and unreliable that one can hardly say what part of England is best. Curiously enough, I believe that our farthest North Station has probably been favored with better weather on the whole than any other. So in this country a sound soil is probably the most important factor. After that, if the aerodrome is not a very big one, open ground in its immediate neighborhood is of great importance, so that a pupil whose engine fails just as he is leaving the aerodrome does not have to turn to land but can go straight ahead and land outside. Road communications are also important, particularly at present; if a good aerodrome is selected at some distance from a good road, a very considerable period of time is expended at first in making a road to the aerodrome before the buildings can be fairly started. A debatable point is always how many pupils or how many aeroplanes can be effectively and safely trained and used at one Aerodrome. We have generally assumed that the ideal number was about 60 pupils, and that for 60 pupils, including machines under repair and in reserve, we wanted about 60 aeroplanes; but of late bigger stations have been organized, although I have no statistics to prove which is the better and most economical system. There is only a certain amount of room in the air, and everyone ought to be out in fine weather. An aerodrome, if possible, should be large enough to provide straights of about one mile in length in several directions. The use of these straights accelerates the first stages of preliminary training very greatly, but they are not absolutely necessary, and in a good many of our aerodromes at home no straight exists.

The Instructor's Qualities

The question of instructors has been a very difficult one from the start of the war. I suppose only about 10 per cent. of our flying officers are really good instructors, if as many; but by sheer force of circumstances, except in a few cases, we have been forced to employ practically every fight commander and flying officer who happened to be in England, as an instructor at one time or other. I have often had qualms on the subject, but the results have really been better than I expected originally, and I do not see how we could have progressed as rapidly as we have if we had used only selected officers for instructors from the start. Instructors have many and various methods, and although it has been suggested that definite orders should be issued as to how pupils should be taught to fly, I have never been able to bring myself to issue such an order for fear of hampering initiative.

The qualities required in an instructor are almost precisely the same as the qualities required in a man whose business it is to break in young horses—*infinite patience, great sympathy, good hands, and a clear, steady head.* Instruction in aviation is distinctly trying to the nerves, and my experience is that an instructor cannot be expected to go on forever. Not only is flying dual control with unknown pupils a test on the instructor's courage—the terrified pupils' iron grip—but the mental strain of watching endless pupils take their first solo flight, or waiting for them to get back from the first two or three cross-country trips, is very considerable. It is also hard to convince the good instructor that he is doing more useful work at home than in France. Another factor now is the high standard of military training required, and this to the ordinary human being is almost harder to teach than aviation. The pupil is less keen and the instruction needs more brains. To obviate this trouble, we have, as I have shown you, two schools of military aeronautics, with a staff of specialists, which carry out as much of the instruction on the ground as possible, and a school of aerial gunnery and a school for observers, which specialize in these two objects.

(To be continued)

THE A. B. C. INJECTOR CARBURETOR

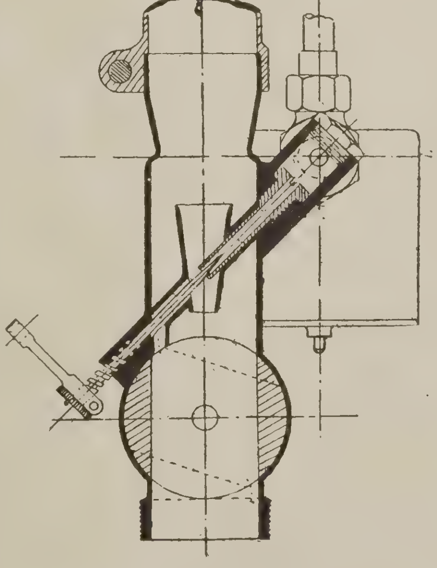
One of the most fascinating problems in connection with internal combustion engines is that of producing the correct gaseous mixture to suit the varying loads upon the engine, and special interest therefore attaches to a new principle in carburetion which has been thought out by Mr. Granville E. Bradshaw, who is well known in connection with A.B.C. Motors, Ltd., of Walton-on-Thames. In the Bradshaw system both compensating devices—for automatically damping out excessive petrol flow with an increased engine speed, and for increasing the suction on the jet according to the amount of throttle opening—are absolutely progressive, and form a straight line curve. The device has been tested under a great variety of conditions and against well-known makes of carburetors, with most satisfactory results.

Before describing the device in detail, it may be as well to state briefly the two general principles which govern the design of all orthodox automatic carburetors. The first concerns the variations in the proportions of petrol and air which occur as the speed of the engine increases. When, for instance, the load on the engine is lessened, the speed increases (the throttle remaining in the same position), the pressure of air in the choke tube is reduced and more petrol issues from the jet. More air also enters the carburetor, but the quantity is insufficient and the mixture becomes rich. The second principle covers the suction on the jet at various throttle openings. As the closing of the throttle would entail a reduction of the suction effect from the engine, arrangements must be made to increase the suction on the jet, and the variation must be regular, or weak and rich periods will be the result.

In the A.B.C. injector carburetor the object has been to get the full value of the injector principle. From the sectional drawing it will be seen that there are two choke tubes, one placed inside the other in such a manner that the other one induces air into the inner one. By this arrangement it is claimed that as the speed of the air into the carburetor increases, a greater quantity of air is injected into the inner choke tube; and as the jet is situated in there, the pressure round the jet—instead of being greatly reduced, as in the usual run of carburetors, thus permitting an excess of petrol to flow—is slightly increased, and the difference in pressure between atmospheric pressure in the float chamber and the pressure in the choke tube is not so great as would otherwise be the case. In this system there is no "dead" point, as the action is dependent upon the speed of air into the carburetor, which varies according to the revolutions of the engine, so automatically correcting for increased engine speed with a given throttle opening.

The adjustment of the suction on the jet according to the amount of throttle opening is obtained by a small slow running tube, which goes from the side of the inner choke tube to a point near to the throttle when this is only slightly open. Consequently at small throttle openings the suction is concentrated on the jet, and as the throttle is gradually opened the suction is lessened in proportion to the opening. Thus there is no "dead" point or any break in the operation.

The size of the jet is controlled by a needle which is designed to be used as an "altitude corrector" when fitted to aircraft engines, or as a dashboard regulator when used on motor cars. It has a primary adjustment in the form of a knurled head, which allows the carburetor to be readily tuned up for any engine; a limited movement is then given to the jet control covering any desired range between very weak and very rich, and the carburetor being entirely automatic this control need not be varied with various throttle openings and engine speeds. If the jet control, for instance, is set to "weak" the carburetion is weak at all throttle positions and at all engine speeds. Similarly if the "control" is set "rich" the carburetion is rich at all throttle position and engine speeds.



A. B. C. injector carburetor.

It is claimed that the arrangement of the control needle in the slow-running tube considerably facilitates starting from cold. If the carburetor is flooded to the smallest extent, petrol will squirt from the main jet into the slow-running tube, where it will remain by capillary attraction until the engine is cranked over. This small amount of petrol mixes with the air existing in the induction pipe and readily forms an explosive mixture. The system of jet control has also the advantage of being adjustable to give an excessively rich mixture, which is of considerable assistance where self-starters are fitted, or in the case of old engines where starting is difficult on account of air leaks past worn inlet valve stems. Incidentally, another point in favor of the jet control is the annular jet, which is less likely to become clogged than a plain hole, and in the event of a piece of dirt making a slight stoppage the jet lever can be adjusted either to remove the obstacle or to give a slightly richer mixture until it is convenient to clean it out. The jet control also permits the use of different qualities of fuel without resetting the carburetor.

Another favorable consideration in connection with the carburetor, especially for aircraft work, is that the risk of fire is greatly lessened, as there are no open ports near to the float chamber, the only air passing into the carburetor entering at the mouth of the hot-air intake.

There are no moving parts in the carburetor, and an entire absence of adjusting screws, orifices, etc., which are so liable to be tampered with. There is only one variable, and that can be adjusted without leaving the driving seat. The simplicity of the carburetor permits of it being of substantial design, and as there are no intricate parts there is practically no liability to accidental damage.

The float chamber is of standard pattern, but is bolted to the side of the main jet boss, so that this can be turned through an angle of 90 degrees. As the jet is at an angle of 45 degrees, the carburetor can be used as a "horizontal" or "vertical" at will, and the level in the jet remains constant for either position.

The carburetor is to be marketed in the following sizes: 20, 25, 30, 36, 42, and 48 mm.

(Reproduced through courtesy of "Flight.")

LONG TAILS vs. SHORT TAILS IN AERODYNAMICS

By Prof. G. H. BRYAN, SC. D., F. R. S., Bangor, and S. BRODTESKY, M. A., PH. D., Bristol

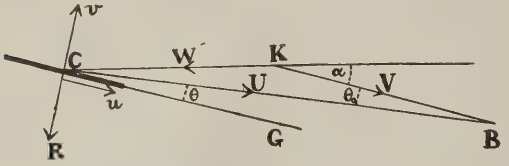
1. Consider any form of aircraft provided with a small rudder plane placed behind its centre of gravity and at a certain distance l from it, which we may speak of as the length of the tail. When this tail is subjected to a given wind pressure, the moment of this pressure about the centre of gravity, tending to turn the machine round, is proportional to l. From this point of view a long tail is preferable to a short one.

On the other hand, the pressure of the air on the tail plane depends on the normal velocity of the wind relative to it. Hence the normal velocity of the plane itself is limited in magnitude, and the angular velocity with which the machine turns about its centre of gravity must therefore be less when l is large than when l is small; that is, the long-tailed machine turns more slowly than the one with a short tail, and this is a disadvantage.

We thus have two conditions which are to a certain extent incompatible, and it becomes interesting and useful to work out a problem in which the joint effect of these conditions is taken into account. In order to avoid complications it appeared to be desirable in the first instance to consider the simplest possible form of system furnished with a tail. The system discussed in the following paper might perhaps be described as a "dart," and may be roughly illustrated by an ordinary arrow. It is assumed to be a heavy body experiencing no resistance itself from the air, and acted on by no forces, but furnished with a rudder plane, the air pressure on which follows the sine law of resistance when the plane is moving in a direction other than tangential relative to the air. In this case the pressure on the tail is wholly employed in overcoming the inertia of the system and changing its motion so as ultimately to bring the direction of motion and the line joining the plane to the centre of gravity into coincidence; or, in ordinary language, to make the system fly in the direction in which it is pointing. The problem presented by an aeroplane or an airship is of course much more complicated, because the pressure on the rudder is largely employed in overcoming the air resistances on the machine itself. In the case of an aeroplane which cannot turn curves without banking, the discussion of the action of a vertical rudder brings us back to the problem of lateral oscillations and lateral stability, while the effect of a horizontal rudder is considered in connection with longitudinal stability.

2. A plane lamina, centre C, so narrow that for moderate angles of attack we may use the sine law for the air pressure and ignore the shift of the centre of pressure, is attached to a system so that the whole mass is M, and the centre of mass is at G, outside the lamina but in its plane. Originally the system is moving with a given velocity V along the lamina and with no rotation. A wind of constant velocity W is suddenly generated at a small angle α with the direction of motion, backwards. To find the oscillation set up, and the best position for the tail, whose size is given. The motion is supposed two dimensional—in the plane of the paper—and there are no applied forces.

It will simplify the work if we consider, not the *actual* motion of the system, but the motion *relative to the air*. The initial relative velocity can be fo the following construction (see Fig.). Measure off CK containing W units length, so that KC represents W, the velocity of the wind; and draw KB parallel to the initial direction of CG containing V units of length, and therefore representing the initial velocity V of the dart. Then CB represents the initial velocity U of the dart relative to the air, and similarly BC, which is equal and opposite to CB,* represents the relative velocity with which the air appears to blow on the lamina initially. The problem of the relative motion thus becomes the same as that of a dart originally projected in the direction CB with a velocity U measured by the length CB. If u v are the relative velocity components of the dart along and perpendicular to the lamina, θ the inclination of the lamina to the fixed direction CB, θ_0 the initial value of θ so that $\theta_0 =$ angle KBC, then we have initially



$$u_0 = U \cos \theta_0 = W \cos \alpha + V,$$
$$v_0 = U \sin \theta_0 = W \sin \alpha;$$

and if α is small, we may take

$$u_0 = W + V;\ \theta_0 = \frac{W}{W+V}\alpha;\ v_0 = W\alpha \quad . \quad . \quad . \quad . \qquad (1)$$

The quantities u, v, θ, define the motion of the dart relative to the air. It is clear, however, that θ represents the *actual* direction of CG at any moment.

3. If CG, the distance of the centre of the lamina *behind* the centre of mass of the system is l, and Mk^2 is the moment of inertia of the whole system about an axis through G normal to the plane of the motion, the equations of motion are as follows:—

$$\left.\begin{aligned} \frac{du}{dt} + v\frac{d\theta}{dt} - l\left(\frac{d\theta}{dt}\right)^2 &= 0; \\ \frac{dv}{dt} - u\frac{d\theta}{dt} - l\frac{d^2\theta}{dt^2} &= -\frac{R}{M}; \\ Mk^2\frac{d^2\theta}{dt^2} &= -lR; \end{aligned}\right\} \quad . \quad . \quad . \qquad (2)$$

where R is the air resistance. As the lamina is narrow, we assume the sine law of resistance and put

$$\frac{R}{M} = Av\,(u^2 + v^2)^{1/2}, \quad . \quad . \quad . \quad . \qquad (3)$$

where A is the reciprocal of a length depending upon the size, shape and aspect of the lamina.

We suppose α small, so that θ remains small for a finite oscillation, and v is also small. We therefore neglect squares and products of $d\theta/dt$ and v; and the equations (2) become:—

$$\left.\begin{aligned} \frac{du}{dt} &= 0; \\ \frac{dv}{dt} - u\frac{d\theta}{dt} - l\frac{d^2\theta}{dt^2} &= -Auv; \\ \frac{d^2\theta}{dt^2} &= -\frac{Al}{k^2}uv \end{aligned}\right\} \quad . \quad . \quad . \quad . \qquad (4)$$

This means that u is constant to the first order of small quantities and equal to U. Eliminating v we get

$$\frac{d^3\theta}{dt^3} + \frac{AU(l^2+k^2)}{k^2}\frac{d^2\theta}{dt^2} + \frac{AlU^2}{k^2}\frac{d\theta}{dt} = 0 \quad . \quad . \quad . \qquad (5)$$

The solution of (5) is

$$\theta = P + Q_1 e^{-\lambda_1 t} + Q_2 e^{-\lambda_2 t} \quad . \quad . \quad . \quad . \qquad (6)$$

where λ_1, λ_2, are the solutions of the algebraic equation

$$\lambda^2 - \frac{AU(l^2+k^2)}{k^2}\lambda + \frac{AlU^2}{k^2} = 0, \quad . \quad . \quad . \quad . \quad . \qquad (7)$$

and P, Q_1, Q_2, are constants defined by the initial conditions.

Measuring the time from the beginning of the disturbance caused by the wind W, we have when $t = 0$,

$$\theta = \theta_0,\ \frac{d\theta}{dt} = 0,\ v = U\sin\theta_0 = U\theta_0,$$

so that at $t = 0$,

$$\frac{d^2\theta}{dt^2} = -\frac{AlU^2}{k^2}\theta_0, \quad . \quad . \quad . \quad . \quad . \qquad (8)$$

to our degree of approximation. After some reduction we find

$$\theta = \frac{\lambda_2 e^{-\lambda_1 t} - \lambda_1 e^{-\lambda_2 t}}{\lambda_2 - \lambda_1}\theta_0 \quad . \quad . \quad . \quad . \qquad (9)$$

It follows from (7) that for a stable oscillation we must have l positive, and when this condition is satisfied, *i.e.*, when the lamina is *behind* the centre of mass of the system, the motion is always a stable one, the system gradually attaining some different steady motion. The ultimate direction of relative motion is along CB. The effect of the tail in this case is to alter the orientation of the dart without affecting its relative velocity. The ultimate orientation is also along CB, *i.e.*, along the direction of the initial relative velocity.

4. The solutions of (7) are

$$\lambda_1,\ \lambda_2 = \frac{AU(l^2+k^2)}{2k^2} \pm \left\{\frac{A^2U^2(l^2+k^2)^2}{4k^4} - \frac{AlU^2}{k^2}\right\}^{1/2} \quad . \qquad (10)$$

The advantage of a very small value of l is that no actual oscillation arises, but a gradual change of direction. But in such a case the decrement of the deviation from steady motion would be slow. In practice λ_1, λ_2, would be con[illegible] so that a damped oscillation ensues. If we write

$$\left.\begin{aligned} \lambda_1, \lambda_2 &= p \pm iq, \\ \text{where}\qquad p &= \frac{AU(l^2+k^2)}{2k^2} \\ \text{and}\qquad q &= \left\{\frac{AlU^2}{k^2} - \frac{A^2U^2(l^2+k^2)^2}{4k^4}\right\}^{1/2} \end{aligned}\right\} \quad . \quad . \quad . \quad . \qquad (11)$$

we obtain for (9)

$$\theta = \theta_0\frac{(p^2+q^2)^{1/2}}{q}e^{-pt}\sin\left(qt + \tan^{-1}\frac{q}{p}\right) \quad . \quad . \qquad (12)$$

Thus at any moment the amplitude of the oscillation is proportional to

$$\frac{(p^2+q^2)^{1/2}}{q}e^{-pt} \quad . \quad . \quad . \quad . \quad . \qquad (13)$$

In order to get the quickest decrease in the amplitude, no attention being paid to the initial extent of the oscillation, we must make p as large as possible, *i.e.*, by (11), we must make k^2/l^2 as large as possible. If, on the other hand, the important thing is to avoid violent oscillations, then we must make $(p^2 + q^2)^{1/2}/q$ as small as possible. This condition easily reduces to $(l^2 + k^2)^2/k^2l$ as small as possible.

5. In an ideal case, where the tail and the connecting rods are supposed to have no mass, k^2 is independent of l. We then get that in order that the oscillation may die down soon, l must be as large as possible. But in order to avoid violent oscillations, we easily find that l must be as nearly as possible equal to $k/\sqrt{3}$. For practical purposes we conclude that *l must be at least equal to $k/\sqrt{3}$* since diminution below this limit involves a double disadvantage.

In an actual flying system, we may expect that

$$k^2 = a + bl^2 \quad . \quad . \quad . \quad . \quad . \quad . \qquad (14)$$

where a and b are known positive quantities. We again get that to make the oscillations die down soon, we must make l as large as possible. In order to prevent violent oscillation, we must have

$$\frac{(l^2 + a + bl^2)^2}{(a + bl^2)\,l} \quad . \quad . \quad . \quad . \quad . \qquad (15)$$

a minimum. This expression is stationary for values of l given by

$$b(1+b)\left(\frac{l^2}{a}\right)^2 + 3\frac{l^2}{a} - 1 = 0,$$

giving the unique possible value

$$\frac{l^2}{a} = \frac{-3 + (9 + 4b + 4b^2)^{1/2}}{2b(1+b)}$$

(*Continued on page 33*)

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* NOTE.—If the velocities of two moving bodies be represented in magnitude and direction by two sides of a triangle, both drawn *from* their common vertex, then the third side represents their relative velocity. Thus in the above figure where KC and KB represent the velocities of the wind and dart, the relative velocity is represented by CB or BC according to whether we are considering the relative motion of the dart or of the wind. This simple construction for relative velocity can be easily verified by supposing two bodies to start simultaneously from the point K with the velocities W and V; then in a unit of time they will have arrived at C and B, so that the line CB will show the change of relative position in unit time, and will therefore represent the relative velocity. This explanation appears necessary because the treatment of relative velocity in many text books is very confusing, and it is our experience that even *advanced students* frequently make mistakes in consequence.

ACCESSORIES

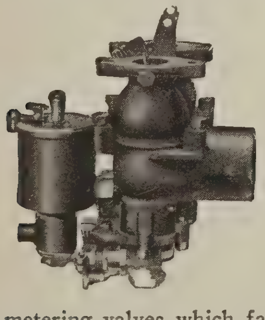
A Spark Plug With Stone Insulation

The difficulty in finding a spark plug which will stand the severe heat and strain incident to use in aeroplane motors presents a problem which is only too familiar. It is for this reason that the plug manufactured by Herz & Co., 245 West 55th street, New York, is of especial interest. This plug is the famous "Bougie Mercedes" of Europe, but is more commonly known here as the Herz Plug. There is no porcelain in its composition, the insulation being of solid stone which is practically unbreakable. In other respects also, Herz & Co. are making a very superior plug. The Clover-Leaf Electrode is an assurance of a highly efficient spark. The plug is self-cleaning, freeing itself from carbon at every explosion, and therefore becomes an actual part of the motor, needing little or no attention after it is installed. The extremely high standard of construction maintained in the making of this plug deserves the highest commendation, and especially where there has been spark plug trouble it will be a good idea to give Herz Plugs a thorough tryout.

Stewart Duplex Carburetor

The new Stewart duplex carburetor for aero motors is of the same principle and design as the regular Stewart duplex with the exception of special details, which have been worked out to make it particularly adapted to aero work in connection with "V" type motors.

The body is of cast aluminum-alloy metal to effect extreme lightness and positive rigidity. This model of the Stewart is known as the racing type, having a complete open air passage around each of the two metering valves which facilitates higher running speeds in the motor.



Requisite to safety in an aeroplane is having the motor under absolute control. The Stewart carburetor with its automatic principle requires practically no further attention after once properly adjusted. However, should ever the emergency arise, immediate control of the carburetor may be obtained through an ingenious dash adjustment extending to the pilot's seat.

The adjustments are so arranged that perfect synchronization is easily obtained between the two blocks of motors. One float bowl maintains a uniform and constant level of gasoline. The butterfly valves are connected on shaft so that in operation each moves to identically the same position, eliminating the possibility of supplying one block of cylinders with more gas vapor than the other.

The manifold flange is cast integral, forming a sturdy and readily accessible connection, making it possible to attach manifolds in straight or off-set position. Trimmings are highly polished nickel and all parts of the carburetor are rust-proof.

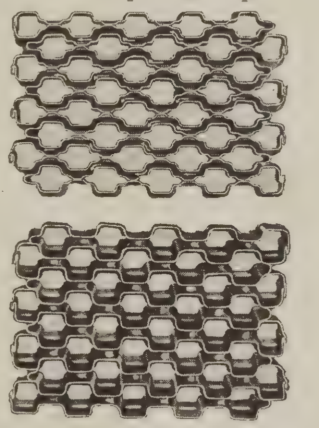
Worcester Pressed Steel Parts

The equipment of the Worcester Pressed Steel Co., Worcester, Mass., enables them to handle parts up to 72 inches long, or 48 inches in diameter, or 13 inches deep, or 1 inch in thickness. Pressed steel parts are made to conform to your particular requirements.

Besides facilities for light and heavy metal stampings, the Worcester Co. has equipment for deep drawing, cold rolling, cold forging, electric and autogeneous welding, plating, pulleys, tubes, strip steel and sheet metal shapes.

Ideal Radiators

The Ideal Staggard Honeycomb Type core possesses all the excellent features which have caused the standard cellular radiator to be accepted as unquestionably superior to other types, combined with many original and exclusive ideal features, while eliminating the one objection to ordinary honeycomb radiators—excessive weight.



Instead of being composed of many hundred individual cellular units, the ideal core is built of strips of tough brass running the entire length, from the top to the bottom of the core. These strips are metallically united every ¾ inch of their length, and the entire core, when completed, is dipped (front and back) into a metal bath. This method of construction produces a core of such lightness, strength and great water capacity, that there is about one pound water capacity to every pound of core weight, and this core is proof against injury by freezing, vibration or any ordinary stresses.

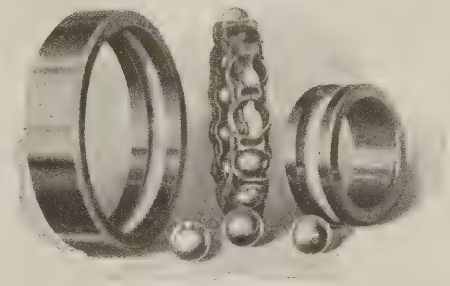
The Staggard or zigzag method of construction used, causes the water to travel about 18 inches to actually progress 12 inches through the radiators. This adds about 30 per cent. to the water capacity and cooling efficiency of the core.

A square foot of 2-inch Ideal core weighs about 7 pounds, holds approximately 3 quarts of water and exposes over 750 square inches of cooling area to the atmosphere by means of over 1,000 ⅜-inch openings. The water travels through the core in 3/32-inch circulating space and, these water channels are cooled on both sides instead of on the outside only, as is customary.

Ideal Radiators are manufactured by the Ideal Sheet Metal Works, Chicago. The upper part of the illustration shows a sectional view and the lower part shows the front view of the cells.

The Fafnir Ball Bearings

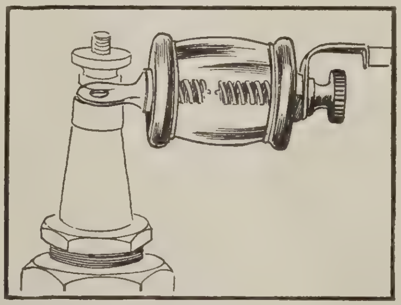
The Fafnir Ball Bearing Company, of New Britain, Conn., took up the manufacture of ball bearings in 1909. Two years were spent in experimental work and the design of special equipment before a single bearing was sold, and their motto has since been "an American product made by American workmanship to the highest American ideals."



The steel used is a high carbon chrome alloy on the same analysis as used by the best European manufacturers. Each individual bar of steel is subjected to test before being machined, and is hardened by special heat treatment and oil quenching, to insure the utmost density and toughness, with a uniformity of steel structure.

Bigelow Spark Intensifier

This little spark plug attachment, illustrated herewith, is attached by simply screwing on the spark plug binding post and to the wire terminal. By merely looking at this device the spark can be seen jumping the gap, so that spark plug trouble is readily detected.



The barrel is made of magnifying glass, and this feature shows up the spark clearly, at night giving a glow like that of an electric light. The intensifier is claimed to overcome all spark plug troubles, making a plug fouled with grease, carbon or soot, or with a broken porcelain, fire perfectly.

RECENT MOTOR PATENTS

1,204,892. ROTARY ENGINE. Walter G. Macomber, Los Angeles, Cal., assignor to Macomber Motors Company, Los Angeles, Cal., a Corporation of California. Filed Apr. 27, 1915. Serial No. 24,196. (Cl. 121—62.) (Illustration No. 1.)

1. A rotary engine comprising a shaft, a cylinder carrier to turn said shaft, cylinders on the cylinder carrier, a stationarily mounted member adjacent one end of the cylinder carrier, a portion of said member extending at an angle relative to the axis of the shaft, a stroke member having bearings at the forward and rear ends of said angular portion of the stationarily mounted member, pistons in the cylinders, pitmen having universal connections with the pistons respectively and having other universal connection with the stroke member, said other universal connections being in a plane extending between the forward and rear bearings of the stroke member, a gear on the cylinder carrier, and a gear on the stroke meshing with the gear on the cylinder carrier.

2. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylinders secured to the carrier with their axes parallel to the shaft, a standard provided with a tubular extension through which said shaft extends, a stroke member journaled on the extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

3. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylinders secured to the carrier with their axis parallel to the shaft, a standard provided with a tubular extension through which said shaft extends, a stroke member having a sleeve, bearings at both ends of the sleeve to journal the sleeve on the tubular extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

4. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylinders secured to the carrier with their axes parallel to the shaft, a standard provided with a tubular extension through which said shaft extends at an angle to the axis thereof, a stroke member journaled on the extension with its axis of rotation corresponding in angle to the axis of the tubular extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a head fastened to the cylinder carrier and journaled on the standard, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

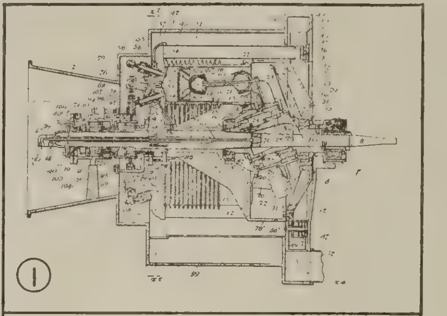
5. A rotary engine comprising a shaft having a longitudinal bore and a vent extending from said bore to the periphery of the shaft, a support having a tubular extension to receive lubricant from the vent and having a vent to drain the lubricant from the interior of said extension, a stroke member having a sleeve surrounding and journaled on the extension and provided with sockets, there being ducts extending from the interior of the sleeve to said sockets, cylinders mounted to rotate with the shaft, pistons in the cylinders provided with sockets, and pitmen having hollow balls engaging the piston sockets and having ducts extending from the interior of said balls to interior of the sockets of the stroke member and said balls having vents extending from their interior to the interior of said sockets.

[Claims 6 to 21 not printed.]

1,210,537. CONSTRUCTION OF CYLINDERS OF INTERNAL-COMBUSTION ENGINES. Edmund W. Roberts, Sandusky, Ohio, assignor, by mesne assignments, to The Roberts Motor Manufacturing Company, Sandusky, Ohio, a Corporation of Ohio. Filed Dec. 2, 1913. Serial No. 804,191. (Cl. 123—193.) (Illustration No. 2.)

1. A jacketed cylinder comprising in combination a cylinder proper, having at one end a projecting boss and at the other end a shoulder, a separately formed jacket fitting over said cylinder and having at one end an aperture through which said boss projects, and at the other end a shoulder engaging the said shoulder of said cylinder, said jacket having, near its said shoulder, a long sleeve portion embracing and fitting tightly a corresponding portion of said cylinder and forming a tight joint therewith, and securing means on said boss securing the cylinder and jacket together.

2. A jacketed cylinder comprising in combination a cylinder proper and a separately formed jacket fitting thereover, one portion of said jacket being double-walled, with its inner wall fitting the cylinder closely, another portion of said jacket being single-walled, such single-wall spaced away from the cylinder, the space between such single-walled portion of the jacket and the cylinder constituting a jacket space, said single-walled and double-walled portions of the jacket being integral.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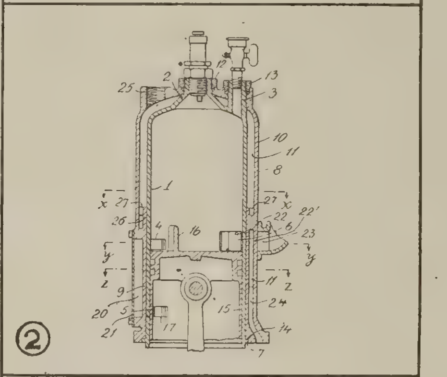
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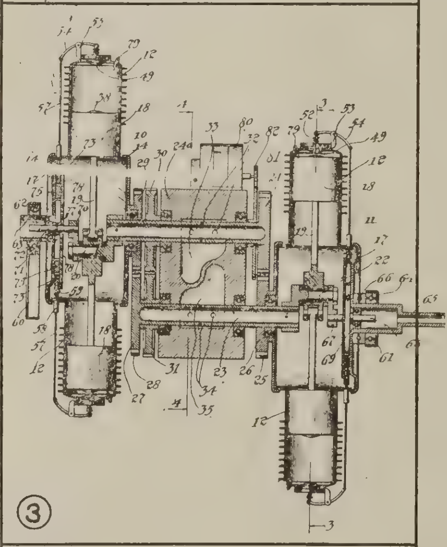
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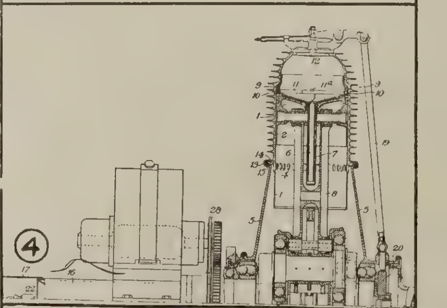
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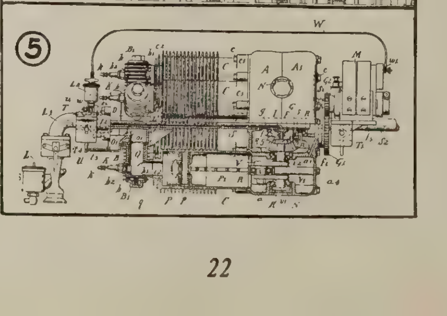
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3. A jacketed cylinder comprising in combination a cylinder proper and a separately formed jacket fitting thereover, one portion of said jacket being double-walled, with its inner wall fitting the cylinder closely, another portion of said jacket being single-walled, such single-wall spaced away from the cylinder, the space between such single-walled portion of the jacket and the cylinder constituting a jacket space, said jacket space in communication with the space between the walls of the double-walled portion of the jacket, said single-walled and double-walled portions of the jacket being integral.

4. A jacketed cylinder comprising in combination a cylinder proper and a jacket fitting thereover, one portion of such jacket being double-walled and having between its walls a jacket space, the inner wall of such double-walled portion fitting the cylinder closely, another portion of such jacket being single-walled, and spaced away from said cylinder, the space between such single-wall and the cylinder constituting a jacket space, said jacket provided with webs connecting the inner and outer walls at points near the end of the inner wall of the double-walled portion of the jacket, said single-walled and double-walled portions of the jacket being integral.

5. A jacketed cylinder for two-cycle internal combustion engines, comprising in combination a cylinder proper having in its sides admission and exhaust ports and a separately formed jacket fitting over said cylinder and having admission and exhaust ports registering with the corresponding ports of said cylinder, a portion of said jacket being double-walled, with its inner wall fitting the cylinder closely, the said ports of the jacket being located in such double-walled portion of the jacket, said double-walled portion extending beyond the region of said ports a distance sufficient to insure a tight joint between the cylinder and jacket, a further portion of said jacket bein single-walled and spaced away from the cylinder, said single-walled and double-walled portions of the jacket being integral.

1,210,409. MOTOR. Thomas P. Brooke, Chicago, Ill. Filed Aug. 1, 1912. Serial No. 712,799. (Cl. 123—44.) (Illustration No. 3.)

1. A motor comprising two sections of cylinders and pistons, one of the sections rotating in opposition to the other section, and provisions whereby the rotation of one of the said sections will actuate the pistons of the opposite section.

2. A motor comprising two sections of cylinders and pistons, one of the sections rotating in opposition to the other section, and provisions whereby the rotation of one of the said sections will actuate the pistons of the opposite section in opposition to the respective section but in the same direction as the actuating section.

3. A motor comprising two sections of cylinders and pistons, one of the sections rotating in opposition to the other section, and piston actuating means operating in opposition to the movement of the respective cylinders and pistons, the piston actuating means of each section being responsive in its action to the operation of the other section of cylinders.

4. A motor comprising two sections of cylinders, rotatable in opposite directions and about different axes, each of said sections operating to counterbalance the gyrational effects of the other section.

5. A motor comprising two sections of cylinders having actuating pistons and rotatable in opposite directions and about different axes, said sections being operatively connected, and means for introducing an explosive mixture directly into each section.

[Claims 6 to 13 not printed.]

1,208,401. INTERNAL-COMBUSTION ENGINE. Felix Joseph Charlemagne Tesse, La Varenne St.-Hilaire, France, assignor of one-half to George Mallison, Eastbourne, England. Filed Apr. 7, 1915. Serial No. 19,844. (Cl. 123—44.) (Illustration No. 4.)
Claims printed in the Patent Office Gazette.

1,215,434. INTERNAL-COMBUSTION ENGINE. Henry L. F. Trebert, Rochester, N. Y., assignor to H. L. F. Trebert Rotary Motor Co., Inc., Rochester, N. Y., a Corporation of New York. Filed Oct. 18, 1911. Serial No. 655,326. (Cl. 123—43.) (Illustration No. 5.)
Claims printed in the Patent Office Gazette.

FOREIGN NEWS

FRANCE

PARIS, March 8.—Willis Haviland and Ronald Hoskier, American aviators, were fighting two Germans over Roye yesterday, without noticing three other German machines hovering over them at a great height.

Suddenly the higher Germans swooped on the Americans. They were forced to dive. When within 5,000 feet the German aviators signaled the earth, whereupon the German anti-aircraft guns opened fire. The Americans escaped, but their machines were riddled with shrapnel.

Walter Lovell and Harold Willis, both of Boston, and Edward Henkle of New York have joined the escadrille at the front.

PARIS, March 9.—Adjutant Ralph Lufbery, the "ace" American aviator in the service of the French, is officially credited with having destroyed his seventh German aeroplane. Lufbery's victorious combat occurred recently. The American flier was the one who put the finishing bullets into the enemy machine.

Conditions in air battling are such that it is often extremely difficult to know definitely to which pilot on the winning side is due the credit for shooting down the foe, especially when several allied and German planes are engaged in the same sector. A banquet was given to Adjutant Lufbery by the pilots of the French squadron in the same sector with the American squadron in honor of his decoration with the Cross of the Legion of Honor. A number of fighting squadrons share the same aviation field with the American pilots.

Each squadron is lodged in a cozy little barracks behind the hangars in which the machines are stored. The American aviators daily make two regular sorties, in addition to various kinds of special and volunteer flying. At first the entire squadron flies between the lines at an altitude of from 1,000 to 3,000 yards protecting the observation machines. This is a very dangerous kind of flying, as the machines are not only within easy range of the German anti-aircraft cannon, but enemy fighting planes are able to swoop down upon them from a superior height and take them at a disadvantage.

The American pilots make another regular sortie, flying far within the enemy lines at an altitude of from 3,000 to 4,000 yards in search of German aeroplanes. Recently they also escorted several French bombing expeditions and fought off attacking Germans. The Americans write that in their sector it has become very hard to find an enemy machine in the air on account of the superiority which the allied aviation corps has established.

Charles Trinkard has been transferred from the foreign legion to the aviation service, and has begun training as a pilot. Trinkard enlisted in the legion in August, 1914, and in the Bois Sabot battle in September, 1915, received two bullets in the right shoulder. After being cured he returned to the front and fought for several months on the Somme front.

George Delpoucho of New York, who was reported killed while fighting as a Legionnaire at Belloy on July 4 last, is now at the front with a French line regiment. He was shot through the body at Belloy and was supposed by his companions to have been killed, but he was taken to a hospital, where he was cured. He has asked to be changed to the aviation corps.

GERMANY

Count Zeppelin is dead. Count Zeppelin is dead, with the dream of his life unfulfilled. It was always claimed by those close to the Count that his ambitions for his aircraft lay not in destroying life, but in linking the new world closely to the old, bringing communication between the two a matter of hours, rather than days or weeks.

The name of Count Zeppelin will always be indelibly linked with the development of those giant air machines to the evolution of which he devoted the best efforts of his long life. He had reached almost the years of an octogenarian, and yet he was seventy years old before he gained any appreciable success in his efforts to perfect a practicable lighter-than-air machine.

Germany stood sponsor for the dream, for the creation that grew out of it and for Ferdinand Count von Zeppelin himself. That some of these giant warcraft have played their part during the present war in the scheme of Prussian, frightfulness is well known to readers of war news. They have crossed the Channel. They have dropped explosives upon London and Paris and have killed scores of inoffensive non-combatants, including women and children. The ranking strategists and tacticians of the Entente Allies, however, contend that as a potential factor among war making forces their influence has been well-nigh negligible. They have succumbed above the land to the attack of the swooping aeroplane and of the aircraft gun, while above both land and sea they have more than once surrendered to stress of the elements.

Though he was a German of the Germans, it chanced to be in the United States that Count Zeppelin made his first balloon ascension. That occurred while he was attached to the command of General Carl Schurz, in the civil war, in the capacity of a German army military observer. A captive balloon in use for military observation by the Union troops greatly interested the young German officer, and he was taken up in it in 1863.

The scion of a wealthy family of ancient lineage, Ferdinand Count von Zeppelin was born in Constance, Baden, in 1838. His childhood home, near Friedrichshafen on the Lake of Constance, was the scene many years later of some of his most successful flights. As a youth he was trained for a soldier's career, receiving his education at the Polytechnic School at Stuttgart, at the Military Academy at Ludwigsburg and at the University of Tubingen. He fought through the Austro-Prussian and the Franco-Prussian wars, and is said to have been the first Prussian soldier to cross the frontier into France in the last named conflict. On that occasion he made a dash across the frontier, it is said, only a few hours after the declaration of war. He was accompanied by only four officers and seven troopers, all of whom were either killed or captured, Zeppelin alone making his escape.

After the consolidation of the German Empire the Count became Plenipotentiary of his native country of Wuerttemburg at Berlin and representative in the Federal Council of the Empire. After serving in the German cavalry for twenty years he attained the rank of general at the age of forty-two. He retired ten years later, a distinguished soldier, to devote all his zeal to the problems of aeronautics.

That study already had engrossed as much of his time as could be spared during the fighting of two wars, though he had given a year to honeymooning with his bride, who was a daughter of the German nobility. It was in 1891 that he began devoting all his time and all his fortune to air navigation. From a wealthy nobleman owning vast estates Count Zeppelin was gradually reduced to an aristocratic mechanic living in a humble cottage on an allowance supplied by friends. He had many narrow escapes from death, and disaster repeatedly overtook his airships.

He had almost become the butt of ridicule. Then in a day it seemed that the adverse tide of years had turned. He electrified a sceptical world in 1898 by ascending from Friedrichshafen.

His monster balloon, 465 feet long, of the rigid type and resembling a huge cigar, soon met with disaster, as had its predecessors. Each wreck was a great financial loss, for the Zeppelin balloons of those days were valued as high as $500,000 each. But Germany now believed in the Count and in his star of destiny. The nation repeatedly rallied to his assistance. When another of his airships was torn from its moorings in gale of wind and wrecked the public subscribed $1,000,000 to a fund, of which the Crown Prince was president, to rehabilitate the inventor. The Emperor frequently helped him out of his difficulties and subsequently the Reichstag appropriated hundreds of thousands of marks for the purchase of his airships for the army.

Even before the European war the record of the development of the Zeppelin was one marked by many disasters. Down to the beginning of the war year, 1914, no less than thirteen of these aerial monsters had come to grief. This is a partial record of the more sensational accidents:

Zeppelin I, as wrecked by explosion August 6, 1908, after being swept from its moorings by storm.

Zeppelin II, was destroyed by a gale April 26, 1910.

Deutschland II, was wrecked by wind while making an ascension at Dusseldorf, Rhenish Prussia. Eight passengers had narrow escapes from death.

Zeppelin VI was destroyed by fire July 3, 1910.

Zeppelin "Substitute Z-1" broke in two, making a landing after a twenty-four hour flight, March 19, 1913.

Z-5 was carried away by storm September 10, 1913, at Leipsic, with a loss of two killed and many injured.

L-1 was destroyed by storm off the Heligoland coast September 9, 1913, with the loss of fifteen lives.

L-11, naval dirigible balloon, exploded at a height of 900 feet above the Johannisthal aviation field, carrying to instant death twenty-six of the twenty-seven men aboard, among them many personal friends of the Kaiser and distinguished officers of the German navy.

Count Zeppelin trained his son, who is also an army officer, in the science of aeronautics and in his method of building dirigible balloons. His daughter, too, became an accomplished aeronaut. She has made more than a hundred flights in the aircraft her father fashioned.

GREAT BRITAIN

According to the official report of March 8, incessant fighting took place in the air above the western front on March 6, in which a prodigious number of German and Allied machines took part. The Germans reported bringing down fifteen machines. The British admit the loss of eleven but say that six German machines were brought down. The British brought about the day of air fights by sending out swarms of aerial observers to photograph and examine the new line on the Ancre to which the Germans have retreated and to prepare for the big operations of the spring. Immediately big squadrons went up to stop them. The report says that the result was satisfactory to General Sir Douglas Haig. The official British report follows:

During the past twenty-four hours there has been no change in the situation. Our artillery silenced hostile batteries which were shelling Ypres. We have again bombarded enemy trenches west of Messines.

There was considerable aerial activity Tuesday, our machines effecting a deal of successful reconnaissance photography and obtaining valuable information. Many bombs were dropped on enemy billets and dumps. The enemy made determined but unsuccessful efforts to stop our work, sending up a very large number of machines.

There was much aerial fighting all along the front throughout the day, during which three hostile machines were brought down and three others driven down damaged. Four of our machines were brought down and seven others are missing.

JAPAN

In view of the backward state of military aviation in Japan as compared with other countries, efforts are being made by the military authorities to effect greater progress in aviation and the extension of the Flying Corps. At present there is only one Flying Corps, stationed at Tokorozawa, and in the Budget for the next fiscal year the Government included a proposal for the establishment of another corps at Kagamihara, Gifu perfecture. Owing to the dissolution of the diet, however, this proposal has been shelved for the time being and unless a new diet is enabled to pass the budget at an extraordinary session after the general election, a delay of another year will take place in the extension of the Flying Corps in Japan.

It is stated that work has been going on for some time at Kagamihara for the laying out of an aviation ground, and the building of an aerodrome and workshop and everything will be completed by March. As soon as the estimates providing for this expenditure are passed by the Diet, the place will become available for use, but until then the establishment will not officially exist.

From *Japan Times*, Jan. 26, 1917:

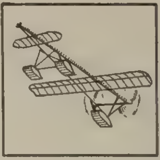
The Imperial Aero Club which has recently been given 10,000 yen by Mr. Soga in Osaka is now spending the money in the construction of an aeroplane for looping purposes. The machine under construction will on completion be equipped with a 90 h.p. engine and be piloted by Mr. Ozaki, the son of Mr. Ozaki, the ex-Minister of Justice. Mr. Ozaki is not a fancy flyer at present but he intends to learn looping the loop in this machine.

Japan Times, January 21, 1917:

Miss Katherine Stinson, the American flyer, is now staying in Kyoto as a guest of Miss M. F. Denton, of the Doshisha Girls' School. On Thursday morning Miss Stinson gave a lecture for students of the Dohisha Girls' School on the subject of "How I Became An Aviatrice." She will go to Kobe to-day where she will catch the O. S. K. liner Tacoma Maru for Manila on January 22.

MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th Street, New York City

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.

LONG ISLAND MODEL AERO CLUB
401 Grant Avenue, Cypress Hills, L. I.

BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn

YOUNGSTOWN MODEL AERO CLUB
924 Wabash Ave., Youngstown, Ohio

DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.

BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge Street, Buffalo, N. Y.

THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

TEXAS MODEL AERO CLUB
517 Navarro Street, San Antonio, Texas

SPRINGFIELD MODEL AERO CLUB
47 Churchill St., Springfield, Mass.

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

The Formation of Model Clubs

To form a model aeroplane club at least six interested persons are necessary. As soon as a place in which to hold meetings has been decided upon the club should proceed to elect a Director whose duty should be to manage the affairs of the club. One of the first things to be considered is the name under which the club will operate; the custom is usually to adopt the name of the Town or City in which the club is located, viz.: Concord Model Aero Club, Concord, Massachusetts, although it is the privilege of the majority of the members to choose a name such as they might feel will best benefit the purpose for which the club was organized. As in the case of the Aero Science Club of America, this club was formed for the purpose of stimulating interest in model aeronautics and to help those who might become interested therein, not only in New York City but throughout the entire United States.

When the matter of name and place has been settled the club should decide upon the course it is to follow, first by electing OFFICERS and second by preparing a CONSTITUTION AND BY-LAWS. In the case of clubs whose membership does not comprise more than six members it does not seem desirable to have more than one officer, namely, a DIRECTOR, who might perform the duties of a President, Treasurer and Secretary until the Club has reached a larger membership. In this way the members are enabled to concentrate upon the construction and flying of models and to engage in such other activities as to carry out the purpose for which the club was organized. However, the foregoing is merely a suggestion on the part of the writer, who by the way is a member of the Aero Science Club of America and formerly acted in the capacity of Secretary to that club.

Clubs who membership totals more than twelve, however, should proceed to elect a President, Treasurer and Secretary, all of whom must receive a vote of at least two-thirds of the membership. With clubs of this size a Director is not needed as the affairs of the Club are usually entrusted with the governing officers, the President, Treasurer and Secretary. In as much as the Constitution and By-Laws are an important factor in the affairs of any model club, the governing officers, before mentioned, should hold a private meeting, at the earliest moment whereat to frame a Constitution and set of By-Laws embodying the purposes and policy of the Club. When the proposed Constitution and By-Laws are completed they should be presented to the members for approval after which a copy should be given to every member.

The following is a specimen of Constitution and By-Laws that might be used by any person or persons desiring to form a Model Aero Club:

Constitution and By-Laws of a Model Aeroplane Club

ARTICLE 1. NAME: The name of this Club will be known as The..............Model Aero Club.

PURPOSE: The object of this Club shall be to study and increase the interest in the science of Aeronautics in every way possible and to realize out this object, shall construct and fly model aeroplanes, glides and man carrying machines. FURTHER, Contests shall be held for model aeroplanes and prizes awarded to the winners thereof. And as a further step in the advancement of this art meetings, lectures, discussions, debates and exhibitions will be held.

ARTICLE 2. MEMBERSHIP: Any person may become a member of this club provided his application receives the unanimous approval of the majority of members, or is passed upon by the Membership Committee. A member may resign his membership by written Communication to the Secretary who shall present it to the Membership Committee to be passed upon.

ARTICLE 3. OFFICERS: The Officers of this organization shall be a President, Vice-President, Secretary and Treasurer and a Board of Governors to consist of said Officers. The President and Vice-President shall constitute the Executive Committee of the Board of Governors, with full powers to act for them in the affairs of the Club. The election of officers shall take place at the first meeting held during the month of .... of each year and shall hold office for one year. In the event of a vacancy occurring in the office of the President the vacancy shall be filled by the Vice-President or next highest officer present. Any other vacancy shall be filled by a temporary officer appointed by the President. The president shall preside at all meetings of the Club and of the Board of Governors, and perform such other duties as usually pertain to that office. The president shall have full authority to appoint Committees or Boards as may be necessary to further the interests of the Club.

The Secretary shall keep a record of all meetings of the Club, Board of Governors and Committees and shall use the seal of the club as may be directed by the Executive Committee. Further, he shall issue notices to officers and members of all special meetings and perform such other duties as may be assigned him by the Constitution, by the Club or by the Board of Governors.

The Treasurer shall have charge of the funds of the Club, receive all moneys, fees, dues, etc.; pay all bills approved by the Board of Governors, and preserve all proper vouchers for such disbursements.

(To be continued in our Issue of March 26th)

Illinois Model Aeroplane Club

A meeting of the Illinois Model Aero Club was held in the rooms of the club, March 2, 1917. Mr. Wm. Sprague read the report of the contest committee announcing a special meeting to be held March 9, at which contests in duration and speed for models having a motor base of seven inches or less would be held. Mr. Wm. Schweitzer gave the report of the membership committee and told of a new club which he was organizing at his school.

The club then had the pleasure of having several talks by well-known men who had attended the Pan-American Exposition in New York. The speakers, Mr. Walter Brock, the prominent aviator, Mr. Muffly and Mr. Hoffman gave very interesting accounts of the exhibit. An unusually large number of members and friends were present.

On March 9th the special contests for seven-inch models was held in the large banquet hall of the Auditorium Hotel. The speed contest was won by P. Breckenridge, whose model averaged twenty miles per hour. The duration contest was won by B. Likosiak with a flight of six seconds. Most of the flights were stopped by striking the walls long before their power was exhausted. A contest for paper gliders was then held in which every boy and man present entered. Ribbons were awarded to the winners of these contests.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Anent Records

One thing we must say in our own favor—we have never hesitated to hold contests for aeroplanes, award prizes and invent machines. Of course, we will admit that these things are purely matters of the imagination, but nevertheless if there is half as much fun in reading them as there is in writing them the object is fulfilled. Now in order that the sky may not be cluttered up with all sorts of aeroplanes, dirigibles, helicopters, ornithopters, balloons, etc., we are going to issue a specification form which we hope may be followed by the authorities in the future. (Of course, we really have no idea that they *will* be followed but at least we can suggest them.)

In the first place we would make the rule that no more than 100,000 machines may be bought by the Army and Navy in one year, because if that limit were exceeded, there might not be enough machines left for private sportsmen. Then we would have a rule that the publicity agents of no aeroplane company could break any record more than eight or ten times in a year. For the way these press departments shatter records is something astounding! Most any day we can pick up a paper and read something like the following:

"Aviator Whois, is about to break the altitude record in a Whatsis machine, with a Nonesuch motor of a few thousand H.P." Or in this manner: *"Suzie Aerofoil, the darling girl aviatrice, intends to break all existing records for duration this spring. She is being managed by that wonderful publicity man, J. M. Rushinprint."* Now that is what we are complaining against. What good are our old faithful records if rash people insist on breaking them all the time? Next we would limit the number of consecutive loops made by any one aviator to thirty, for the way these exhibition men are looping is extraordinary! Some years ago we were thrilled when some aviator went aloft and by a combination of skill and good fortune managed to land again with his frame intact. But now? Are we satisfied to see a simple flight well executed? Are we? We are not! We must see side-slips, dives of death, loop-the-loops, upside-down-back-reversible-side flying. The worst of it we encourage these men. When a report comes in that Aviator Somebody has looped the loop ninety-five times in percussion without blinking an eyelash, we applaud feebly and murmur, "Huh! That's not so much; why, I remember way back three years ago when that feller, I can't remember his name, flew upside down for three hours, yes sir, *three hours.* Of course, we know we are not telling the truth. But we must refuse to believe that anything is better than it was in the olden days. So the aviators explore the record books, looking for new records to break. If every record has been fractured beyond recognition and they are hard pressed, why they just invent some new competition and establish a record in that.

Now, if this thing goes on like this, why before long the records will all be so wonderful that they can never be broken again, and that will take all the zest out of flying. We will fly so high that the force of gravity will be lost and we will glide off into regions celestial. We will fly so fast and so far that we will meet ourselves coming back the other way. Just think of the possibility of a terrible accident when a fellow is flying so fast around the world that he even exceeds his own expectations and bunks into himself on the way back!

And we must limit the greatness of all the constructors. Every day a manufacturer announces that he has just completed the greatest machine ever built. Now with hundreds of aeroplane manufacturers in the world each turning out the greatest machine ever built every day, before long each machine will be better than the one better than it, every machine will be faster than a faster machine, every aeroplane constructed will be the largest in the world, and Lord knows where we will stop. We will have achieved the infinite, reached the ultimate development, and exceeded the bounds of reason. We will have improved so much that we cannot better our product and then will be forced to build nothing but inferior machines!

Is that not a sad thought?

Our Own Technical Department

I. X. L. We do not know what Monosoupape engine is, but we suspect that the name is French for "Pesky."

M. B. A. "Stationary Engine" may be used to describe almost any motor, when it refuses to run.

O. P. K. To find the horse-power of any motor, look it up in the prospectus of the company, divide the answer by six, and use three engines where one is called for.

R. A. T. The reason that the "3 in 1" control is not used any more is that it was found to be very oily.

E. S. D. Never land a flying boat anywhere except in the water.

P. O. I. We doubt very much if the United States Army could use your invention, but you might try the Long Island Institution for the Feeble-Minded.

P. A. W. The term "Aviation Section" is used because "section" means a small part of something.

W. S. Q. The first airship owned by the United States Navy is called "D-N 1." As you have suggested in your interesting letter, perhaps the members of the crew will supply the missing letters in the name.

S. A. W. There is no reason to believe that a triplane is three times as fast as a monoplane.

P. A. O. We are sorry to disappoint you, but matrimonial questions are entirely too acute and technical for this department.

W. Q. A. The formula for that cheap gasoline you bought is H^2O.

"YA WOULDN'T THINK THAT PARACHUTE WOULD HOLD A FELLER LIKE BILL"
"I SHOULD THINK TH' BLOOD WOULD ALL RUSH TO HIS HEAD, WOULDN'T YOU?"
"GRACIOUS!"
WM. A. JOHNSTON, AUTHOR AND EDITOR, WANTED TO DROP FROM A BALLOON HANGING TO THE PARACHUTE BY ONE FOOT
WHAT WAS YOURS?
(Copyright 1916, by H. T. Webster.)
CROSS MARKS SPOT WHERE BILL'S BEST GIRL IS STANDING
WEBSTER

Courtesy of N. Y. Globe

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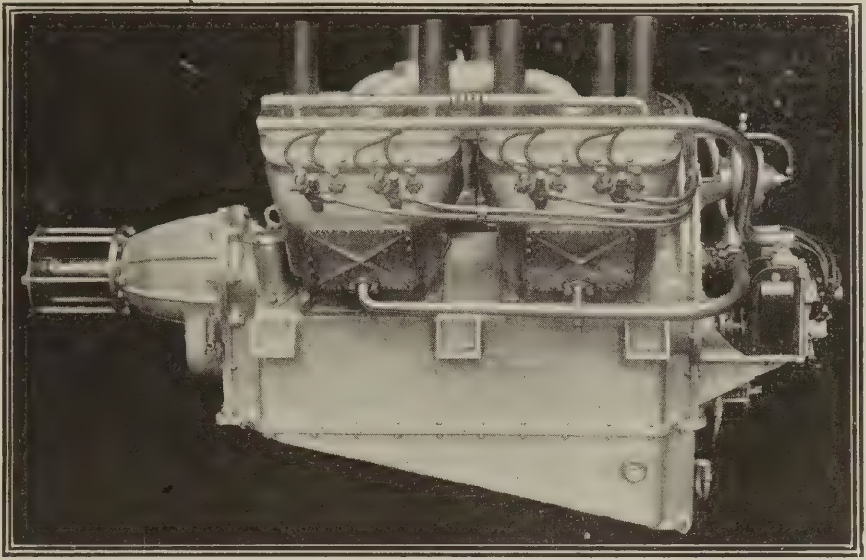

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(*Continued from page* 16)

and 174 H.P. at 1450 r.p.m. Weight of motor, 307 kgs. A complete description of the Mercedes engine was given in the September 11, 1916 issue of AERIAL AGE.

The propeller is direct driven and of two captured, one made by Heine, Berlin, had a diameter of 280 mm. with 190 mm. pitch, and another, labelled "Intergal—J. P. W.," had a diameter of 270 mm. and a pitch of 140. The former propeller was made of walnut and mahogany, and the latter of walnut, ash and sycamore in alternate laminations. Weight of propeller 19 kgs.

The gravity tank is V shaped to conform with the slight dihedral of the upper plane. It is fitted between the foward and rear wing beams and attached to the central inverted V struts from the fuselage. A filler pipe projects above. The gravity tank has a capacity of 26 litres and the main tank 195 litres. A three-way tap permits the motor to be fed either under pressure from the main tank, or by gravity. An oil tank as placed on the right of the motor and has a capacity of 20 litres.

The radiator is located just forward of the gravity tank, in the upper plane. It fits in a space provided for it between the forward main spar and the leading edge of the plane.

Fuel is carried weighing 170 kgs. Water, 25 kgs.

(*Continued from page* 11)

II.

Copper shop.
(a) Gasoline tanks.
(b) Fittings.
(c) Leads, overflow pipes, exhaust pipes, and drains.
(d) Patterns and shapes.
(e) Brazing.

III.

Fabric Shop.
(a) Material used in covering.
(b) Method of securing to surfaces.
(c) Doping and varnishing.

BALLOONS

Shop Instructor, Captain R. S. Geiger, U. S. M. C.

Asst. Shop Instructor, Lieut. (j.g.) R. R. Paunack, U. S. N.

Balloons.
(a) Lecture on free and kite balloons.
(b) Prepare balloon for flight.

1. Lay out to inflate.
2. Inflate when possible.
3. Handling balloon during ascension.
4. Make up as after flight.
5. Repairs to fabric.
6. Cementing on rip panel.
7. Nomenclature of all parts, lines and gear.
8. Two hours or more in hydrogen plant.

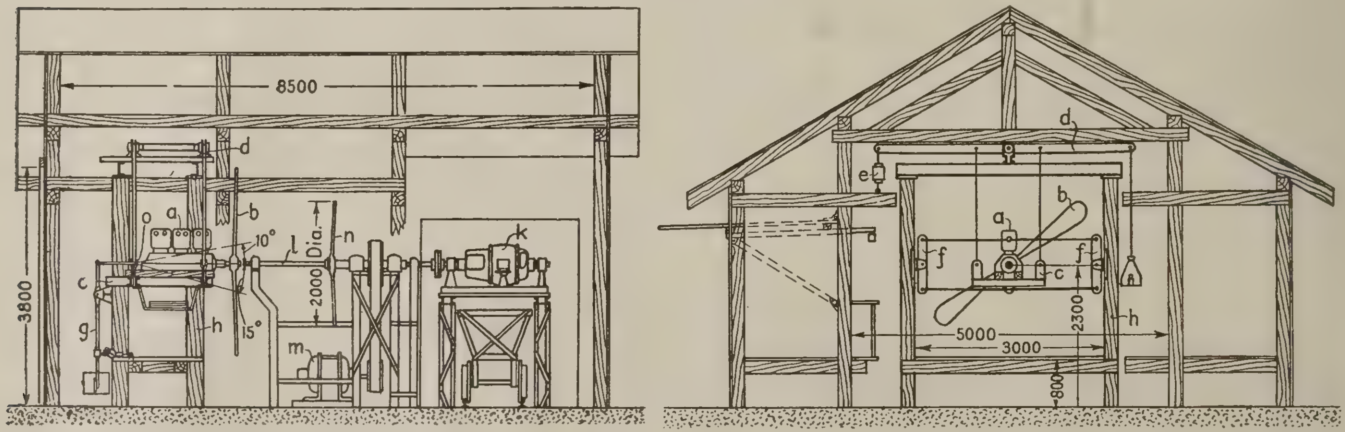


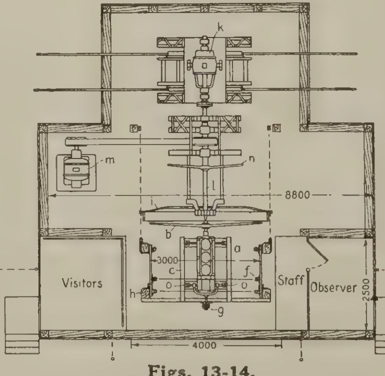
Fig. 12

instruments could be checked. For measuring the thrust ordinary spring balances were used, a heavy one being employed to measure the thrust of the propeller when driven by the engine, and another lighter one to record the head resistance of the engine when the propeller was driven by the electric motor *k* (Fig. 12), driving a blast of air on to the engine.

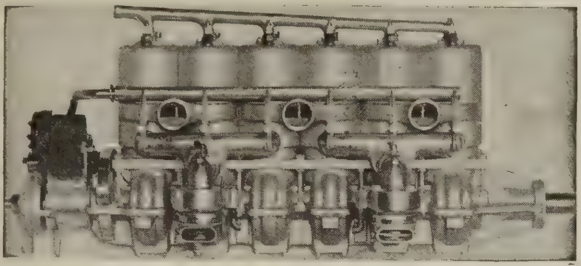
Apparently this head resistance was merely measured as a matter of interest, and not because it was important. As stated previously, the engine as a rule is built in the fuselage, and possesses little or no individual head resistance. However, the apparatus lent itself to obtaining, in a simple manner, figures for the head resistance, and these were therefore taken.

The electric motor *k* shown in Fig. 12 was of the kind in which the field can turn against the resistance of weights carried upon an arm, so that the power passing through it can be very accurately measured without reference to efficiency curves. This motor required to have a capacity up to 150 h.p., and apparently it was a very delicate instrument not easily obtainable. Although five test cradles were erected, it was only found possible to obtain one of the test dynamo motors *k*. Rails were therefore provided for transporting the electric motor from one cradle to another, and this and the truck appear in Fig. 12.

To obtain the torsional resistance due to air churning in the case of rotary engines, a dummy engine was made, and this was driven by a separate electric motor mounted upon the cradle and the necessary figures obtained. It was assumed that the loss by churning is about 10 per cent. of the engine's output, and therefore a 15 to 20 h.p. motor was provided for. For cooling the rotary air-cooled engines the fan *n* was used, driven from the motor *m* (Fig. 14), which delivered air at about 20 meters per second.



Figs. 13-14.



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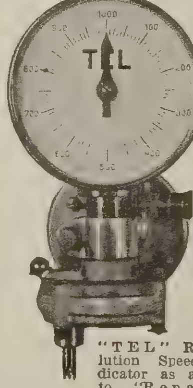

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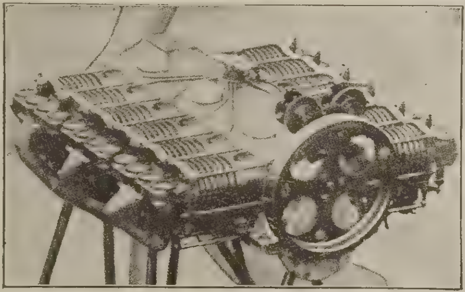

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Suggestions for Recording Field Tests

Attention is called to the very timely paper on "Suggestions for Standard Tests of Aeroplanes" by Mr. Jno. J. Rooney, Aeronautic Engineer of the Wright-Martin Aircraft Corp., read at a recent meeting of the S. A. E. and published in the February 12th issue of AERIAL AGE. In the article it is pointed out that the aeronautical industry in this country is not making the progress it should, and as an aid to progress more scientific methods should be used in making field tests of aeroplanes. It is, of course, urgent that immediate steps be taken to improve these methods.

Form IV of Mr. Rooney's paper, which is given below, contains a systematic collection of data necessary to be records in such tests. As this field test record is the most complete form that has so far been suggested, it is hoped that manufacturers will realize the advantages to be gained by closely following it.

IV—SUGGESTED FORM FOR RECORDING TEST DATA

........Test of Model.........Aeroplane No.............
Manufactured by ....
Test made for..........................at...........o'clock
.............19...., on..............Field..........U. S.A.

Dimensions and Description

Lenth of Course, miles: circular..........straight..........
Total Weight of Aeroplane and Load on Test..........lb.
Useful load: men...............lb.; fuel...............lb.;
oil................lb.; other weights.................lb.

Engine

Manufacturer ....
Model..........Serial Nos.: Right..........Left..........

Propeller

Manufacturer ....
Dwg. No..........Serial Nos.: Right..........Left.........

Remarks ....
....

Condition of aeroplane over Course	Time, min.	Altitude, ft.	Air-Speed Indicator Readings, m.p.h.	R.p.m. of Engines		Angle of Attack, deg.
				Right	Left	
Standing	......	......	......	......	......	....
Flying with Wind	......	......	......	......	......	....
Flying against Wind	......	......	......	......	......	....
Flying across Wind	......	......	......	......	......	....
Landing	......	......	......	......	......	....
Climbing	1	......	......	......	......	....
Climbing	2	......	......	......	......	....
Climbing	3	......	......	......	......	....
Climbing	4	......	......	......	......	....
Climbing	5	......	......	......	......	....
Climbing	6	......	......	......	......	....
Climbing	7	......	......	......	......	....
Climbing	8	......	......	......	......	....
Climbing	9	......	......	......	......	....
Climbing	10	......	......	......	......	....
Climbing	......	max	......	......	......	....

Get-Off

Time......min. Distance......ft.; against wind......across wind.............. Condition of Field....................

Weather Conditions

Sunny or Cloudy..

Temperature..................................deg. F.

Barometer......................................in. Hg.

Height above Sea Level.................................ft.

Wind

Direction..

Velocity......................................m.p.h.

Steady or puffy..

Uptrend..

Witnesses

Signature of Official Observer..............................

Signature of Pilot..

NOTE: Baragram, photographs, etc., should be attached to this report.

(*Continued from page* 21)

Thus the oscillation is least violent for

$$l = \left[\frac{a \left\{ -3 + (9 + 4b + 4b^2)^{1/2} \right\}}{2b(1 + b)} \right]^{1/2} \quad . \quad . \qquad (16)$$

since this makes (15) a minimum. In practice this value of l would be a lower limit.

When b/a is small, (16) becomes approximately

$$l = \frac{\sqrt{a}}{\sqrt{3}} = \frac{k}{\sqrt{3}} \quad . \quad . \quad . \quad . \quad . \qquad (17)$$

agreeing with the result previously found.

6. Since θ ultimately vanishes it will be seen that the direction of motion ultimately becomes parallel to CB, and this therefore represents the direction of the asymptote of the path. It is, however, important to determine the distance of this asymptote from C, as this represents the total displacement of the dart in a direction perpendicular to CB relative to the air. This displacement is obviously equal to

$$\int (u \sin \theta - v \cos \theta)\, dt \quad . \quad . \quad . \quad . \qquad (18)$$

which for our purposes of approximation may be taken to be

$$\int (U\theta - v)\, dt$$

Now from equations (4) we obtain

$$\frac{dv}{dt} - U \frac{d\theta}{dt} = \frac{k^2 + l^2}{l} \frac{d^2\theta}{dt^2} . \quad . \quad . \quad . \quad . \qquad (19)$$

This is the equation obtainable by taking moments about the centre of the tail. It follows from this that the total displacement is equal to

$$-\frac{k^2 + l^2}{l} \theta + C_1 + C_2 t \quad . \quad . \quad . \quad . \qquad (20)$$

where C_1 and C_2 are constants. But since the initial velocity perpendicular to CB is zero and θ is initially equal to θ_0, the total displacement becomes equal to

$$\frac{k^2 + l^2}{l} \theta_0 \quad . \quad . \quad . \quad . \quad . \qquad (21)$$

This is a minimum when $l^2 = k^2$. If, however, $k^2 = a + bl^2$, the condition for a minimum becomes $a = bl^2 + l^2$ and therefore $k^2 \doteq (1 + 2b) l^2$. In any case there is a certain length of tail for which the displacement is least.

If, however, we consider the total displacement of the *centre of gravity* we must subtract $l\theta$ from the above amount, and the total displacement sideways now becomes equal to $\theta_0 k^2/l$, showing that a long tail is the best.

It is easy to obtain a generalisation of this last result for the case of any kind of aircraft whose motion may be treated as two dimensional. In such a case there is at every instant a point on the axis of the system through which the resultant air resistance passes. This point takes the place of C the centre of the tail. The main difference is that since the components of air resistance depend both on the linear and angular velocities of the system, and these are not in general proportional throughout the motion (for v is initially finite and $d\theta/dt$ initially zero), the distance of this point from G, which we have hitherto denoted by l will now be variable. The total displacement of G at right angles to the direction of final motion will now be

$$= -\iint \frac{k^2}{l} \frac{d^2\theta}{dt^2}\, dt^2 . \quad . \quad . \quad . \quad . \qquad (22)$$

We may write this equal to $k^2\theta_0/[l]$ where $[l]$ denotes some quantity such that $1/[l]$ is intermediate between the greatest and least values of $1/l$. In any case it is advantageous from this point of view that $[l]$ should be large.

7. The preceding investigation of the small oscillations is, however, only a particular case of the more general problem of aeroplane stability. A more useful estimate of the initial action of the tail plane can be obtained by expanding θ in powers of the time by means of the exponential series. We thus obtain from (9)

$$\frac{\theta}{\theta_0} = 1 - \frac{\lambda_1\lambda_2 t^2}{2!} + \frac{\lambda_1\lambda_2(\lambda_1 + \lambda_2)t^3}{3!}$$
$$\frac{\lambda_1\lambda_2(\lambda_1^2 + \lambda_1\lambda_2 + \lambda_2^2)t^4}{4!} + \quad . \quad . \qquad (23)$$

Making use of the formulæ for the sum and product of the roots of the quadratic (7) this gives

$$\theta_0 - \theta = \frac{AlU^2}{k^2} \theta_0 \left\{ \frac{t^2}{2} - \frac{AU(l^2 + k^2)}{k^2} \frac{t^3}{6} \right.$$
$$\left. + \frac{AU^2\{A(l^2 + k^2)^2 - lk^2\}}{k^4} \frac{t^4}{24} - \dots \right\} \quad . \qquad (24)$$

This equation shows that the initial angular acceleration of the system is greatest when l is large, but in this case the angular acceleration decreases more rapidly than it would do if l were small, thus confirming the general statements at the commencement of the present paper.

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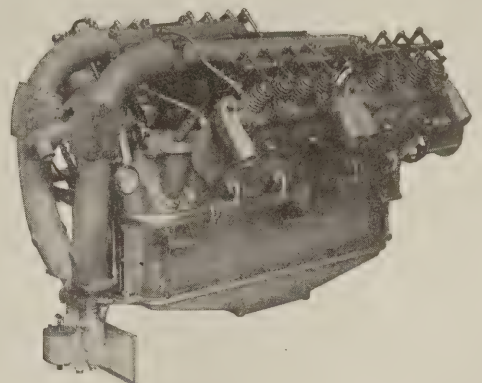

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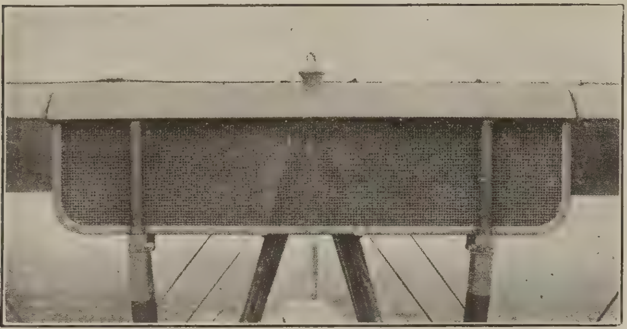

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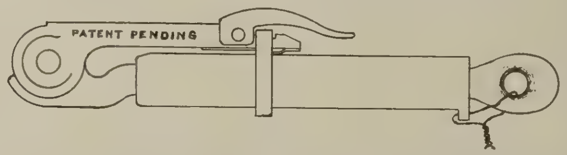

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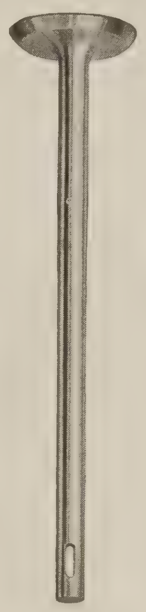

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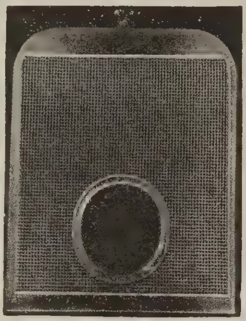

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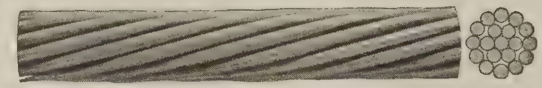

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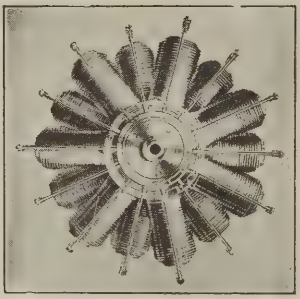

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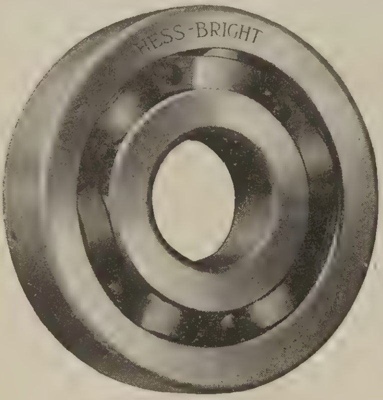

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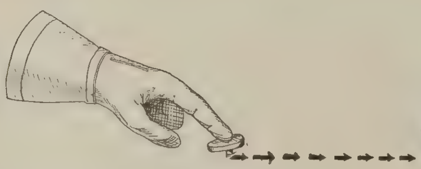

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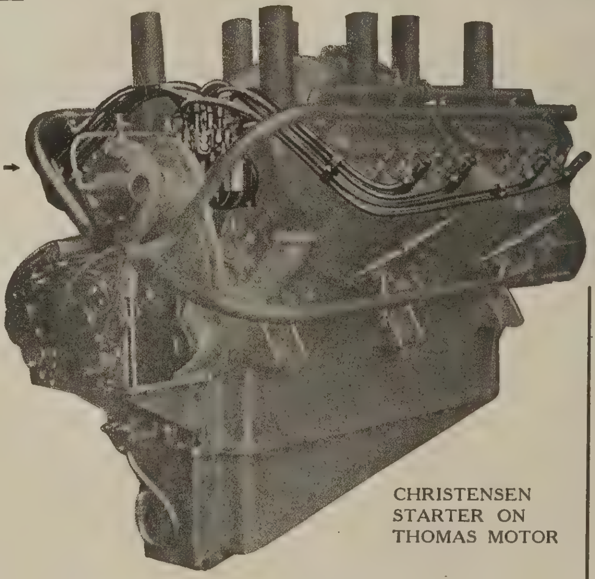

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AERIAL AGE

WEEKLY

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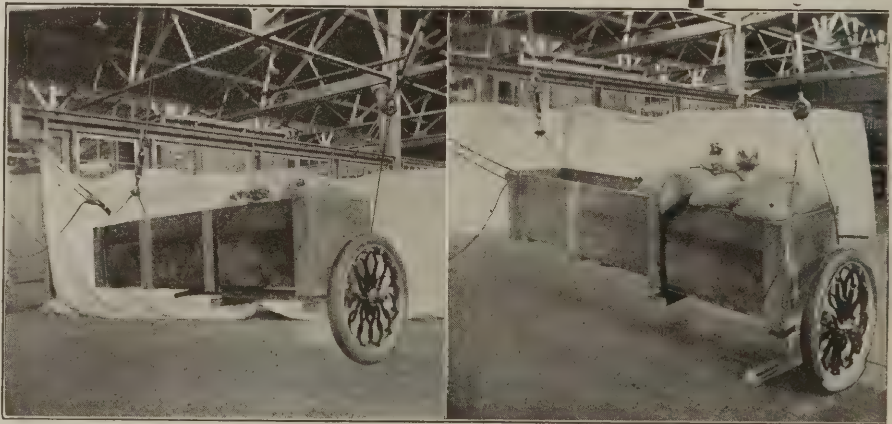

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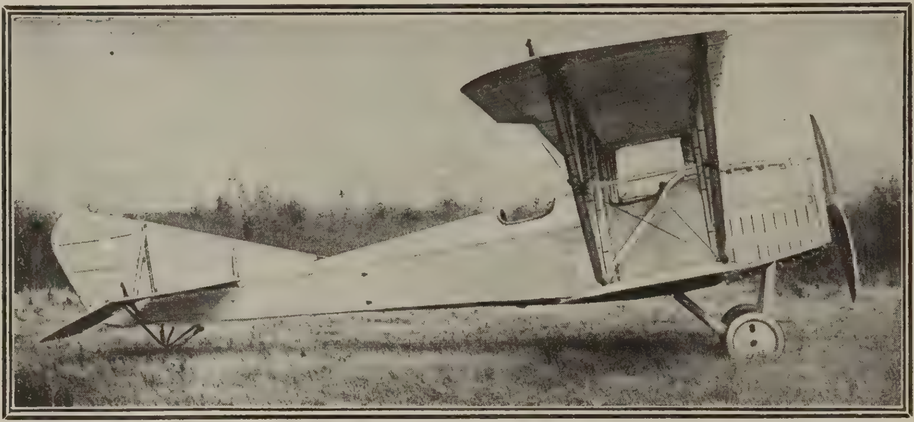

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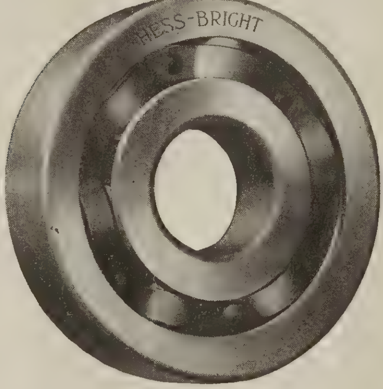

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VOL. V NEW YORK, MARCH 26, 1917 No. 2

QUICKEST WAY TO PREPARE DEFENSE OF UNITED STATES AGAINST INVASION IS TO DEVELOP LARGE AND POWERFUL BATTLEPLANES

REAR ADMIRAL FISKE, whose inventions and achievements rank him with the leading naval authorities of the world, in a memorandum to Mr. Alan R. Hawley, the president of the Aero Club of America, points out that one hundred large battleplanes carrying 3-inch guns would afford the defensive power of about 60,000 rifles.

As Admiral Fiske has ably pointed out, the battleplanes would afford a combination of power and mobility easily obtainable and thus solve easily the problem of quickly building our defenses. Shots from 3-inch guns carried by these battleplanes would sink destroyers, transports and submarines and prevent the landing of troops on American soil, when nothing else could.

Can these battleplanes be obtained? The answer is in the affirmative—and AERIAL AGE will tell in a coming special number all about large battleplanes and the prospects of obtaining them in the near future.

Admiral Fiske's memorandum reads as follows:

"In view of the backward state of our defenses, especially on the land, I would like to suggest the advisability of considering whether it is not possible to devise some means that is powerful and easily gotten, in order to supplement our present means: Something that can do for our army and navy service a little like what the Monitor did in 1862. The exigencies of the Civil War, especially the menace given by the Merrimac, caused the hurried building of the Monitor, which Ericson had been trying to have built for several years. The Monitor fulfilled her mission perfectly. Had the Monitor not been built, the Merrimac would have prevented the blockade of the southern coast, the south would have been able to sell her cotton; would have received money, munitions and equipments in exchange, and would probably have been recognized by some of the European powers, and been able to resist successfully the armies of the north. It was the Monitor that cast the deciding vote in our Civil War.

"As the submarine threatens to cast the deciding vote in the present war and as the Monitor has been expanded into the dreadnought, it may be profitable to ask what is the inherent cause of the efficiency of those weapons. Clearly it is the same cause as makes any weapon efficacious; that is concentration of great power in a small space, combined with great mobility. The combination permits of the application of great force on a given spot at a given time.

"In 1911, I published an article called "Naval Power," in the United States Naval Institute, in which I pointed out this fact, and suggested what a battleship on land could accomplish, if such a thing could be constructed. The *Popular Science Monthly* republished this suggestion in November, 1915, and a few months later, the so-called British tanks appeared, which are small land battleships.

"Now the unevenness of the ground is a great obstacle in the way of making land battleships very large and fast, and seems to prevent armies from using units as powerful and swift as navies use. This is unfortunate for a country like the United States, for two reasons: One reason is that the length of our boundaries on the ocean and on our northern and southern frontiers is so great, and the average distance to the boundary from places within the country is so great, that it would be highly advantageous for us to be able to move powerful units at great speed; another reason is the natural inventiveness of our people would enable them to produce very effective land battleships, if the difficulties were not absolutely insuperable—as they seem to be.

"My life in the navy brought me into intimate contact with all the advances in naval construction—from the little Saratoga in which I made by first cruise as cadet midshipman to the superdreadnought Florida, which was my last flagship. The military value of concentration was of course impressed unceasingly upon me, and with it a realization of the fact that the main aim of strategy and tactics is to bring a preponderatingly force to bear on a given point, before the enemy can prevent it. To do this, we need concentration of power in as few units as possible, and ability to move those units as rapidly as possible. POWER AND MOBILITY ARE THE PRIME AGENCIES OF THE MILITARY ART.

"Now at the present time the unit in all armies is the soldier and his musket. We seem tied down to that slow and feeble little unit. But are we really? The navy seemed tied down to the little sailing frigate; so much so that even after the Montor's achievements in our civil war, we returned to the sailing frigate. The competition of nations, however, forced us to take up larger units, and now we have the Pennsylvania.

"Is there no way in which this greate inventive and constructive nation can get some more powerful and mobile unit than the soldier and his rifle? Can we not get more defensive usefulness out of the intelligent collegian, technician or chauffeur than by marching him in a regiment with a little musket in his hand? Is there no device by means of which large units of power can be carried which is not subject to the limitations of speed and size that restrict a land battleship to small dimensions?

"Yes, and that device is now being used in Europe, after having been designed and manufactured in the United States. It is called the battleplane. Such a device recently carried 27 passengers, and another, an air cruiser, carried 3500 lbs. of crew and equipment. Some of the largest battleplanes are being constructed in the United States and one of the aeroplane manufacturers states that he can easily build a battleplane capable of carrying and launching a full size torpedo weighing 3500 pounds.

"If battleplanes have a field of usefulness in Europe, where the distances are very small and where the organization, training and strategical employment of large armies have reached a high state of development, do they not have a much wider field in the United States, where the distances are relatively enormous, and where the organization, training and strategical employment of large armies are arts almost unknown? Is it not possible that an immediate and strenuous development of battleplanes might save us from invasion, just as the Monitor saved us from the Merrimac?

"In case our fleet is defeated in the Atlantic during the next year, we shall not have an army that could stand up against any European army that might land on our shores. But if we had a division of say one hundred battleplanes near New York, costing about three million dollars, we could certainly prevent the disembarkation, transit in boats to the shore, and landing of any force of soldiers, especially if the battleplanes were assisted by say two hundred small aeroplanes, dropping bombs. Similar divisions at other points, including one at the Panama Canal, could perform similar services, and the great speed of the air craft would enable each division to guard a long extent of coast. A division of 100 battleplanes could go from New York to the Capes of the Chesapeake in three or four hours. They could be equipped with 3-inch guns. The muzzle energy of 100 3-inch guns is equal to the muzzle energy (and therefore destructive power) of about 60,000 soldiers' rifles.

"The size and power of the aeroplanes has already gone far beyond the limits set for its possible development by certain engineers only three years ago. The practical difficulties of making it larger still are quite apparent; yet, nevertheless, no theoretical limits to its size and power have yet been accepted by aeronauts. That the aeroplane is now the best single weapon against the submarine is conceded. That the aeroplane, and especially the battleplane, will rapidly advance in size and power within the coming year and afterwards, is the mature belief of many aeronauts; should we not therefore immediately investigate its capabilities, not only as a scout and accessory, but as a major instrument of warfare?

"I do not suggest the abolition of the soldier and his musket; but neither do I suggest the abolition of the boat pulled by the oars of rowers. I merely suggest that, as the boat pulled by rowers was superseded for large operations by the sailing ships, and as the sailing ship was superceded by the more mobile steamer with broadside guns; and as this type of warship was superceded by the turret ships, and as the turret ship has been expanded into a super-dreadnought, so the soldier and his musket may be superceded for important operations by the immeasurably more powerful and mobile battleplane.

"If so, the more quickly we act, the better. 'Hindenburgh never sleeps.'"

REFORM IN AIR SERVICE CAUSES CHANGES IN FOREIGN GOVERNMENTS

GENERAL LYAUTEY, a new French War Minister, has resigned following disagreements caused essentially by projected reforms in the French air service.

The struggle for aerial supremacy in Europe has been responsible for many changes in the British and French Governments in the past two years. Before that there was an occasional change of subordinate heads of the air service. It will be recalled that the British Assistant Secretary for War, Col. Seeley, was the first to go on account of failure to develop the Royal Flying Corps. His successor, Assistant Secretary Tennant also had to go for failing to work out the necessary reform. Then Lieut. Col. Mervyn O'Gorman, who had for a number of years been the Superintendent of the Royal Aircraft Factory was demoted—his demotion being the result of a nation wide agitation for reform in the administration of the air service, which was the prime factor in also causing a thorough change in the British Government. In other words, when developing the air service was only a measure of preparedness the subordinates were punished for the failures to train a larger number of aviators and get adequate equipment; but when war came and the administration remained sluggish, and the failure to develop the air service endangered the very existance of the nation, which was willing to spend $250,000,000 in twelve months to gain and maintain its supremacy in the air, then the country forced the changing of the entire Cabinet.

In France, Assistant Secretary Besnard was put in charge of aeronautics last year in a position which was virtually the position of an Air Minister. But he found, as the British reformers found, a deeply rooted, selfish bureaucracy, similar to the sluggish, self-seeking British bureaucracy, which opposed practically every suggestion of development in the air service, for no other apparent reason than the fear that with the developments might be put other men in charge.

So Besnard resigned, and General Lyautey has also resigned.

France is due for a house cleaning similar to the house cleaning that resulted in the establishing of the British Air Ministry, which was the first step of the new British administration.

This house cleaning may not be easy but it is expected that it will be easier than the British house cleaning. The latter was a hopeless proposition for a number of years and it required a change of the entire Government administration to do it.

The British experience showed what an amazing power a few retrogressive bureaucrats, using the Government machinery, can have for evil. A very small number of retrogressive bureaucrats who were themselves incapable of developing the air service sought to prevent others from doing it, essentially from fear of losing their positions or fearing reflection on their own actions if they followed lines of progress suggested by those patriotic, far-seeing people who sought to develop a larger and more efficient air service.

In some cases the men were only obsessed with the past limitations of aeroplanes and their minds simply could not accept the progress which had been made in aeronautics. So they restricted its development and application for military purposes. But their obsession was a menace to national safety, and they had to be removed—which was eventually done.

Then there were the crank theorists who spent most of their time trying to disprove that aeroplanes designed and built outside of the Royal Aircraft Factory could be better than the R. A. F. products; and the official scoffers who scoffed at everything that did not emanate from the Royal Aircraft Factory and repressed by suppression all outside efforts to develop a greater air service. To these must be added those misguided individuals who, as the official investigation brought out, actually appropriated ideas submitted to the Royal Aircraft Factory by outsiders.

It had been thought that these evils would disappear when the Royal Aircraft Factory was confined to experimentation and manufacture of spare parts, but they did not disappear, they rather grew worse as the air service extended and the Royal Aircraft Factory employed 3,000 men.

Occasionally the British public and press would express its displeasure at the limitations of the air services and would refuse to accept the impressively phrased reports of officials, which usually praised the departments for what they claimed to constitute "progress"—and then there would be a change in officialdom. Several under secretaries were changed and the head of the Royal Aircraft Factory was removed and finally an Air Board was instituted. The administration of the Royal Flying Corps alone now occupies about 350 offices in London.

The selfish, retrogressive office holders craftily used the entire bureaucratic machinery to oppose the appointment of the first Air Board and succeeded in having the Board shorn of power.

But, as is usually the case with people of this type, their small minds could not grasp the immensity of the situation and realize the necessity of getting and training thousands of aviators and providing them with a sufficient and efficient equipment.

As is usual in such a case, progressive executive officers in both the British Army and Navy, were powerless to stamp out the evil, being unwilling to have quarrels in the bureaus. The bureaucrats operated the government machinery to their advantage and stopped at nothing to suppress and silence their critics. Aeronautics being a new science the superior officers had to rely on different section officers for information. These officers seemed to have formed a clique and they seemed to stop at nothing to carry out their selfish purposes.

They hampered and obstructed every progressive move started outside of their offices and persistently forced on the Royal Flying Corps R. A. F. products quite inferior to machines and motors developed by private firms.

They whitewashed each other and attempted to blacken the character or ridicule any critic that happened to criticise their inaction or inexcusable delays and favoritisms.

But with the tremendous growth forced upon them there came a large number of new officers, including a great many progressive men who soon found out the status of affairs and undertook the work, leaving these selfish officers to their selfishness.

Finally the public and press got tired of excuses and promises, of reports on alleged "superior" technical developments and complaints of "unfounded" charges. These things did not defend the British Islands from Zeppelin attacks, and did not keep the coasts free of submarines and the skies free of German aeroplanes.

The British aeronautic magazines that carried on the propaganda which resulted in the establishing of the new British Air Board deserve much credit.

One magazine in particular, *The Aeroplane,* is to be congratulated. The editor of this magazine worked untiringly for aerial preparedness, carrying a weekly fight against the sluggish Royal Aircraft Factory and the evil of Government construction which prevented Great Britain from getting an adequate air service before the war and urging persistently the establishment of an air ministry.

The bureaucrats fought him in a low, malicious way. They actually resorted to trying to force manufacturers to cut out their advertising from *The Aeroplane,* attempting to bribe manufacturers with orders to carry out their insidious scheme. But *The Aeroplane* published the facts about this plot and the manufacturers' patriotism and manliness balked at being part to such a low scheme, and the result was that *The Aeroplane* received greater support, while the malicious bureaucrats were demoted.

Fair at all times, the editor first tried praising and urging; then he tried to impress upon them that his one interest was only to get the substantial aerial defenses needed in the interest of the country and that he was only too anxious to cooperate with them and help them in every way possible. Finding it impossible to make progress he just did his duty. He rendered Great Britain a great service by continuing his fight in spite of all the discouraging experiences he had.

An Order in Council signed by the King on February 6th sets up the Air Board, which is constituted as follows:

President—The Right Hon. Viscount Cowdray (Minister of the Air).
Parliamentary Secretary—Major J. L. Baird, M. P., C. M. G., D. S. O.
Fifth Sea Lord of the Admiralty—Commodore G. Paine, C. B. (The Admiralty's Air Lord.)
Director-General of Military Aeronautics—Lieut.-General Sir David Henderson, K. C. B.
Controller of Aeronautical Supplies—Mr. William Weir.
Controller of Petrol Engines—Mr. Percy Martin.
Secretary—Sir Paul Harvey, K. C. M. G., C. B.
Assistant Secretary—Mr. H. W. W. McAnally.
Private Secretary to the Parliamentary Secretary—Mr. C. G. Evans.

The constitution makes provision for such additional members as may from time to time be found desirable.

In the event of one or other of the Admiralty, Army Council, Aeronautical Supplies, or Petrol Engine Departments' representatives being unable to attend a meeting of the Board, the department to which he belongs may designate an officer to attend in his place. Members of the Air Board other than those who are appointed in virtue of their offices shall be appointed by the President of Board, and shall hold their appointment at his pleasure.

General Lyautey had decided to amalgamate the various departments of the air services and to place them under one central authority in Paris, under his own control, but with General Guillemin in charge. It was understood that General Guillemin was to eventually have charge of both the Army and the Naval air services. Until that time M. Thomas, the Minister of Munitions, was to continue to control the manufacture and supply of aircraft. Just what happened is not yet known in details. The fact is that General Lyautey has resigned as Secretary of War as a result of disagreements over plans for the development for air services.

This last development and the fact that there is still a feeling that the plan to give Great Britain 20,000 fully equipped aviators is not being developed as fast as it should, and that air raids on Germany are not as numerous as they could be may result in bringing about the appointment of an Allied Air Board. And that may be a great step forward.

THE NEWS OF THE WEEK

Aeronautic Stations to Guard Coast

Washington, D. C.—A joint Army-Navy board is studying the Atlantic and Gulf Coasts preparatory to the establishment of eight aeronautic stations, which besides having two dirigibles and six or eight seaplanes each for aerial patrol work, probably will serve as a base for the new 110-foot coast scout boats of which the Navy will order more than a hundred in a few days. Sixteen dirigibles and a sufficient number of seaplanes have already been contracted for, and officers and men for the air service are being selected to be sent to the station at Pensacola, Fla., for training. A school dirigible for the station is about ready for delivery.

The eight stations will be distributed along the coasts to cover strategic areas to be determined by the board. Each will require six officers and forty men.

The only station site already definitely selected is that at Coco Solo, near Colon, Canal Zone, for which an appropriation of $1,000,000 to establish a joint aviation and submarine base was asked of the last Congress. The project is expected to go through at the coming special session. Funds for the other stations will be asked at that time, but the department has emergency appropriations sufficient to begin the work at once. The dirigibles are to be delivered within four months.

At present no stations for the Pacific Coast are being prepared, although the chain of coast patrol bases will be extended along the entire coast line as rapidly as machines can be procured and men trained.

The immediate scheme requires the training within the next four months of fifty officers and 350 men at Pensacola in handling dirigibles. Crews for the seaplanes are already under training, but their number must be increased largely without delay.

In providing boats to aid in the task of guarding the coasts navy experts would prefer a standard type 130 foot steel boat for patrol and submarine chasing work, but in the interest of speedy construction has determined on the 110 foot craft, with wooden hulls, so that builders of wooden boats can share in the work. Later orders will be placed for some small submarine chasers ranging from fifty to eighty-five feet in length.

Fort Totten May Be Plane Station

New York.—Colonel William G. Haan, commandant of Fort Totten, is a member of a joint naval and military board named by the War Department to consider sites for aeronautic stations along the Atlantic coast for the protection of the coast cities.

A large number of hydro-aeroplanes are now being built by the government and will be used jointly by the army and navy. It is said that Fort Totten may be chosen as the station for the hydro-aeroplanes that are to protect New York City.

Foreign Branches for U. S. Rubber

New York City.—Chas. F. Guest, who has represented the United States Rubber Co. in Mexico for a number of years, has sailed for Manila, where he will open a new branch for the company. The new office, of which he will be manager, will handle a large part of the Oriental trade of the company, formerly in the hands of the San Francisco office. Another new branch will shortly be opened by J. A. McKenzie in Australia to handle the growing U. S. Rubber business there.

Aeroplane Factory for Davenport

Davenport, Iowa, will have an aeroplane factory in operation by March 26, manufacturing military tractors, both land and water machines.

Mr. Billy Cook, a pilot with great experience, has been retained as head of the construction work. The backers of the company plan to have an up-to-date flying school near the factory, training pupils on machines built at the factory. They report that they have twenty-five applications at the present time. Besides acting as head of the construction, Pilot Cook will be instructor in the school.

Stewart-Warner Election

Chicago, Ill.—At a recent election of the Stewart-Warner Speedometer Corp., Chicago, the following officers were named: President, C. B. Smith; Chairman of the Board, L. H. LaChance; Vice-Presidents, V. R. Bucklin, W. J. Zucker, T. T. Sullivan; Secretary, W. J. Zucker; Treasurer, T. T. Sullivan.

Flying Routes to Be Mapped

New York.—Plans by which the United States will be surveyed to establish aeroplane routes and landing stations, both for military and civilian aviators, are being worked out at the Government Flying School, at Mineola, L. I. These plans have already progressed so far that the regular officers of the school and a committee of the reserve aero squadron have begun to arrange for suitable landing stations at various distances, even as far away as Philadelphia, and to mark these stations in such a way that they will be easily distinguishable from the air.

The scheme as projected by Capt. Joseph E. Carberry, commandant of the school, is expected to enlist not only the aid of all aero clubs and the War Department, but the Coast and Geodetic and the Geological Surveys.

Capt. Carberry and the fliers of the school have carried on a number of experiments and as a result within a short time the big field at Mineola is to be marked with a big star of canvas, the points of which will be twenty-five feet in diameter. Other fields at Oyster Bay, Port Washington and other points will be similarly marked. In addition, a symbol will be attached to each marker which will denote the character of the field of landing, its proximity to repair stations and even to hospitals in case of accident. By this means an aviator, looking for a place to land, can pick out a field which suits his needs.

It has been found that the tent hangars of the field at Fort Sill, Okla., are visible eighteen miles away at a height of 6,000 feet.

In addition to charting out the countryside, the reserve fliers of the Hempstead Plains School are planning a course of work under conditions closely simulating actual warfare. Maps of the countryside are being made from aeroplanes, and more than 200 topographic photographs have been filed away this year. These photographic maps have a great advantage over the ordinary scale maps in that they show detailed conditions of the terrain below and the exact location of even the smallest buildings and landmarks.

The camera is to take another important part in training the civilian aviators. It is to be used in target practice. With a camera mounted on his machine instead of a machine gun, but operated by regular gun sights and trigger pull, the student aviator will soon be sent up with orders to "bring down" a certain machine designated as the enemy. The scheme works on the natural presumption that if a flier can aim well enough to get a bullseye through his camera he could do it with a rapid fire gun.

800 People See Franco-American

Eight hundred representative people attended the latest of the remarkable entertainments which Mr. Alan R. Hawley, the energetic president of the Aero Club of America, conducts so successfully in the beautiful ball room of the Automobile Club of America.

The motion pictures included films of the work of the American Ambulance, but the popular film was the one showing the Franco-American Flying Corps. The corps were shown in flight and in their camp. The famous American aviators, William Thaw, Norman Prince, Elliott Cowdin, Kiffin Rockwell, C. C. Johnson, Lufbery, Chapman, and others were shown, and received a rousing reception.

The speakers included Henry A. Wise Wood, Lieut. George H. Roeder, of the American Ambulance Corps in France, and Miss Mary Lawton, who recited stirring poems.

Mr. Henry A. Wise Wood announced an important plan to build a million tons of "Ford" merchantmen advanced by F. Huntington Clark, a mining engineer, of 30 Broad Street, to break the German high seas barrier. Mr. Clark's plan received the indorsement of Rear Admiral Bradley N. Fiske (retired).

Wooden, motor-driven, little merchantmen, low in the water, quick on their heels and without smoke or tall masts to betray them at a distance, are the craft recommended by Mr. Clark. They would average 185 feet long, 34 feet beam, 18-foot draught, with a cargo capacity of 1,000 tons and a speed of 14 knots. Mr. Clark estimated that the capacity of the yards the first year would be 1,000,000 tons, and Mr. Wood suggested last night that with the adoption of Ford methods of standardization the capacity of the yards would be virtually unlimited.

No expensive plants would be required; a planing mill, a couple of saws and such accessible timber supply as exists in the Beaumont district of Texas and on the Pacific Coast are the only requisites. Steel demand, congestion of rolling mills and shipyards would not affect the new industry. Three vessels a year could be built on the same ways, it is said.

The ships would cost about $100,000 apiece. The operating cost would be about $4,000 a month. The gross returns at the present rate would be from $15,000 to $20,000 a month.

Such ships, even when picked up by a submarine, would present a much more difficult mark for the torpedo. They would be small and of slight draft and would be able to dodge quickly. They might almost be considered too small to warrant the discharge of an expensive torpedo. If the missile did hit its mark the loss in life and property would be comparatively small.

Mr. Clark would arm each boat with two guns. He points out that a pair of guns is a pair of guns, whether mounted on a ponderous 10,000-ton liner or a nimble 1,000-ton jitney of the seas. One would be as dangerous to the U-boat as the other. Owing to the low visibility of the smaller craft Mr. Clark figures that their entry would necessitate three times as many submarines to maintain the blockade, and he is confident that the little boats could be turned out faster than they could be sent to the bottom.

If the United States were involved in war, he pointed out, such an auxiliary fleet would be of immense value for patrol purposes and as mine sweepers.

Those present were the members and their friends of the Automobile Club of America, the Aero Club of America and the Motor Boat Club of America, under whose joint auspices the weekly entertainments are held.

Aeroplanes Rushed to Essington Base

Philadelphia, Pa.—Within a few hours after the announcement that the United States War Department had decided to take over the Philadelphia School of Aviation at Essington for the purpose of converting it into a base for air squadrons to co-operate with the Atlantic reserve fleet at League Island supplies from the Government began arriving at Essington.

Nor did the War Department lose any time in placing an officer at the head of the school, for it was announced that Captain William Ocker, who recently flew from Long Island to Washington, carrying Congressman Bleakley, of Franklin, Pa., from this city to the capital, would take active charge at once. Captain Ocker is an officer in the United States Reserve Corps, having recently been promoted from the rank of sergeant.

About $2,000 worth of cable wire, several typewriters and other office equipment have already arrived at the school. Bills of lading, received by Walter E. Johnson, who has been chief instructor, show that four aeroplanes, two motortrucks, two motorcycles, two motorboats—capable of making forty-five miles an hour—and considerable machine shop equipment are already on their way to Essington.

The Government, having decided to maintain a base for an aerial fleet and a school for the training of reserve air squadrons at Essington, will spare neither money nor effort for its development. It is said that the War Department is prepared to spend $250,000 to make it an efficient arm of the United States fighting forces.

New Connecticut Aviation Field

Greens Farms, Conn.—The new aviation park, which is situated just west of New Creek at Burial Hill Park, Greens Farms, is the eastern end of Sherwood's Island, and it appears to be most admirably situated for this purpose. It has a fine stretch of sandy beach, with New Creek to be improved for a harbor and the new Burial Hill Park road, which the town built last year, for an approach. It has access to the new water main on Beachside avenue and also electric light connection at that point.

To Test Packard Aero Engine

Detroit, Mich.—Within the next two weeks the Packard Motor Car Co. will install its aeroplane engine in an aeroplane and test it by flight at Joy Field.

Goodyear Adopts Metric System

Akron, Ohio.—The metric system of weights and measures will be introduced in the plant of the Goodyear Tire and Rubber Company. This means that in all weighing system, in all its mould designs and in all of its machinery designed in the plant the company will use the metric system.

The completion of this move will extend over a period of months. Draftsmen are already provided with metric scales and drawings are being arranged along this line.

The pusher biplane of the General Aeroplane Co., Detroit.

To Aid Our Aviators Fighting for France

New York.—An entertainment, followed by a ball, was held in the Waldorf-Astoria March 16 to augment the fund which has been raised for the relief of the American Aviation Corps and the Ambulance Francaise de Pierrefonds, a hospital in the little village of Pierrefonds, near the firing line, to which soldiers too seriously wounded to permit of their removal to the base hospital, are taken for emergency treatment.

Many prominent artists, among them Marie Dressler, who directed the entertainment; George M. Cohan, Trixie Friganza, Gertrude Kingston, Georgia Caine and Adelaide and Hughes, volunteered their services, and Conrad's Orchestra furnished the dance music.

Three members of the American Aviation Corps, Robert Rockwell, Frederick Zinn and Elliot Cowdin, who have distinguished themselves by their exploits in France, among the guests, and bluejackets from the U. S. battleship Arizona acted as ushers.

Indiana Guardsmen for Aviation Corps

Indianapolis, Ind.—Three Indiana guardsmen will depart soon for San Diego, Cal., where they will be trained in flying to become aviators for the Indiana National Guard. The men pioneers in the field, so far as the Hoosier guard is concerned, will form the nucleus of an aviation corps for the I. N. G.

The three are First Lieutenant Ernest Clark of Terre Haute, first battalion of the Second infantry, Sergeant Major Frederick I. Elgin, also of the Second infantry and another first lieutenant of the Second infantry, whose name is withheld by request. The guardsmen took examinations in aviation while they were on the border.

Bock Bearing in Standard Parts

Cleveland, Ohio.—Control of the Bock Bearing Co., Toledo, Ohio, has been secured by the Standard Parts Co. of Cleveland, thus placing the latter company in a position to make the entire running gear. William E. Bock, president of the Bock Company, will continue to head its affairs and will be a director of the Standard Company. It is planned to turn out 10,000 bearings a day.

J. G. Utz has been appointed chief engineer for the Standard Parts Co. He has been with the Perfection Spring Co., now a Standard Parts subsidiary, for five years. E. W. Dunston has been appointed chief engineer for the spring division, and R. A. Townsend has become chief metallurgist in charge of the spring division laboratories.

Army Balloonists Fight Snowstorm

Gibes, Mo.—Three United States Army balloonists left here by train for Omaha March 18 after a struggle for five hours in a snowstorm at an elevation of 10,000 feet.

The balloon was piloted by A. Leo Stevens, chief instructor of the United States balloon corps, at Fort Crook, and also carried Captain H. J. B. McElgin and Lieutenant L. C. Davidson. They left Omaha Saturday morning and landed here at half-past four in the afternoon.

On reaching an altitude of about ten thousand feet they encountered a severe snowstorm which cut off all view below and prevented them from attempting a landing for five hours.

Detroit, Aero Club Elects Officers

Detroit.—The Aero Club of Detroit held its annual luncheon and meeting recently, electing a Board of Governors.

The newly elected governors are: A. Verville, of the General Aeroplane Co.; G. W. Dunham, consulting engineer; W. B. Stout, aeroplane engineer of the Packard Motor Car Co.; K. C. Zimmerschied, of the General Motors Co.; D. McCall White, engineer of the Cadillac Motor Car Co.; R. O. Gill, manufacturer and manager of the Saxon Motor Car Co., and R. W. Judson, vice-president of the Continental Motors Co.

At a recent meeting of the Board of Governors, the following officers were elected: President, Sidney D. Waldon; vice-president, Henry B. Joy; vice-president, Fred M. Alger; treasurer, R. D. Chapin, and secretary, Mason P. Rumney.

Aviator Finds Lost Engineers

Miami, Fla.—After being lost in the Everglades for more than a month, three New York engineers were found by Phil. Rader, the instructor at the Curtiss Aviation School, here.

They started from Miami about five weeks ago on an engineering trip, with food to last them but three weeks, and only by carefully conserving it have they made it last. The search for the men lasted almost three weeks and brought in the native Florida residents, Seminole Indians, and the aviators from the Curtiss School.

Aerial Reserve in Training

Washington, D. C.—The first quota of twenty-three men from the enlisted Signal Reserve Corps has arrived at three aviation schools on the Atlantic seaboard to undergo six months' training. Seven will be trained at the Curtiss School at Newport News, Va.; seven at the Curtiss School at Miami, Fla., and nine at the Signal Corps at Mineola, L. I.

New Hydrodynamics Text Book

N. W. Akimoff is completing a text book on Applied Hydrodynamics, meant mostly for Aeronautic engineers. The book will be of the same general character and meant for the same class of readers as his recent book, "Lagrange's Equations." Mr. Akimoff would be glad to receive suggestions on the part of all engineers interested in the technical end of Aeronautics as to topics which they would be especially anxious to see worked out in detail.

Curtiss News

Some very interesting information has recently been furnished by officers of the United States Army relative to flights made during the past few months by Curtiss aeroplanes on the Mexican border. For about six weeks last summer mail aeroplanes left Columbus, New Mexico, every other day for Gen. Pershing's headquarters at Colonia, Dublan, Mexico, about 115 miles south. A return trip was made the next day.

All first class mail for troops carried, and on some trips, all classes of mail up to 300 pounds in weight. Bulk of mail, not weight, was usually the limiting factor.

All planes flying from one station to another carried mail, averaging about two mail-carrying flights per week for about six months. Average distance mail carried each flight about 160 miles.

In addition to mail all sorts of articles have been carried, as the following list taken at random shows:

	Lbs.
Pilot and passenger.	
Military equipment consisting of arms, food, water, tools, first aid pack, sleeping bags	140
Mail, three bags	130
Two spare magnetos	40
Butter	30
Bedding	12
Candy	4
Jam	10
Total	366

Not a single piece of mail was lost.

Average flying time, between Columbus and Dublan, about one hour and fifteen minutes. Greatest flying time between above points, two hours.

On February 13, 1917, the Curtiss speed boat Miss Miami, powered with a Curtiss 12-cylinder V-4 aeronautical motor, made an unofficial world's record by traveling sixty-five miles per hour over a measured course at Miami, Fla.

Army and Navy News

Capt. John C. P. Bartholf, junior military aviator, S. C., now on leave, is relieved from further duty at San Diego, Cal., and will proceed to Hampton, Va., for duty as supply officer at Experimental Station.

Capt. William C. Ocker, Aviation Section, S.O.R.C., is relieved from duty in the office of the Chief Signal Officer and will proceed to Essington, Pa., for the purpose of organizing a temporary aviation station for the training of personnel for a proposed aero squadron to be located near Philadelphia (March 12, War D.).

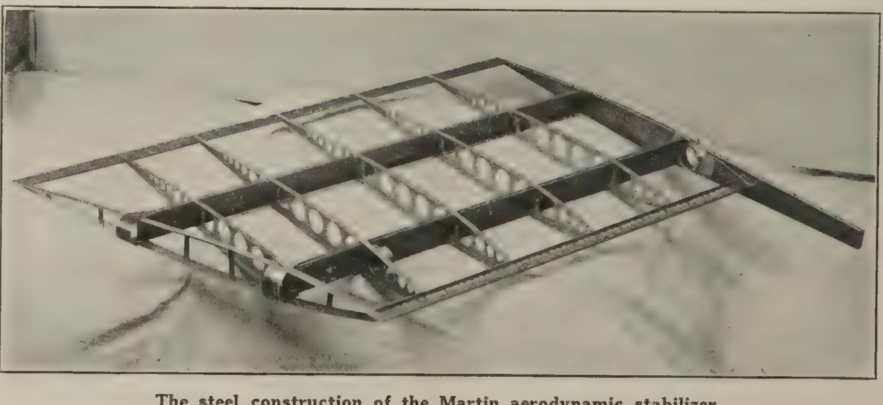
Sergt. 1st Class Roland G. Blake, S.C., Fort Myer, Va., to Miami, Fla., for duty at the Curtiss Aviation School. (March 13, War D.)

Sergts. William A. Hoeveler, Jr., and Joe G. Trees, of the S.E.R.C., Key West Barracks, Fla., to active duty at the Curtiss Aviation School, Miami, Fla., March 12, 1917. (March 9, War D.)

Sergt. Samuel P. Mandell, 2d, of the S.E.R.C., Fort Monroe, Va., to active duty in the Aviation Section, with station at the Curtiss Aviation School, Newport News, Va., March 12, 1917. (March 9, War D.)

Sergts. James W. Watts and Edwin M. Welch, of the S.E.R.C., Fort Monroe, Va., are assigned to active duty in the Aviation Section, with station at the Curtiss Aviation School, Newport News, Va., March 12, 1917. (March 9, War D.)

Sergts. Arthur L. Richmond, Frederick H. Harvey, John Mitchell and Hamilton Coolidge, of the S.E.R.C, Key West Barracks, Fla., are assigned to active duty in the Aviation Section, with station at the Curtiss Aviation



The steel construction of the Martin aerodynamic stabilizer.

School, Miami, Fla., March 12, 1917. (March 9, War D.)

Sergt. Lloyd L. Harvey, of the S.E.R.C., Fort Monroe, Va., to active duty in Aviation School at the Curtiss Aviation School, Newport News, Va., March 12, 1917. (March 9, War D.)

Sergts. Randolph G. Page and Gilmore L. Tilbrook, of the S.E.R.C, Fort Monroe, Va., are assigned to active duty in the Aviation Section at the Curtiss Aviation School, Newport News, Va., March 12, 1917. (March 9, War D.)

Sergt. Howard N. Murphy, S.E.R.C., Fort Monroe, Va., is assigned to active duty in the Aviation Section, with station at Curtiss Aviation School, Newport News, Va., March 8, 1917. (March 7, War D.)

Sergt. Dunn K. Steele, of the S.E.R.C., now on duty at the Curtiss Aviation School, Newport News, Va., to Miami, Fla., for duty at the Curtiss Aviation School at that place. (March 9, War D.)

The make-up of the joint Army and Navy Board shows the importance of the plans that are under way. It includes, besides General Squier, Major Stanley O. Embick, U. S. A., assistant to the Chief of Coast Artillery; Major Dan T. Moore, General Staff, Army War College; and from the Navy, Capt. Hugh Rodman, of the Navy General Board; Capt. Josiah S. McKean, assistant for material in the office of the Chief of Naval Operations; and Capt. George R. Marvell, in charge of naval districts in the same office. The latter is representing the Secretary of the Navy on the board. At the same time that this board is meeting in Washington a commission composed of Capt. Shepler W. Fitz Gerald, Signal Corps, U. S. A., an officer of Coast Artillery and two from the Navy, are traveling along the coast inspecting possible sites for the joint bases.

A special meeting of the National Advisory Committee will be held March 22. Army and Navy officials and representatives of the manufacturing end of the industry will meet on that date in the Munsey Building, Washington, D. C., for the sole purpose of expediting the production of aeroplanes.

Goodyear Purchases Fabric Mills

Akron, O.—The proceeds of the recent stock issue of the Goodyear Tire & Rubber Co. will be used in part for the financing of a deal whereby the Goodyear company buys fabric mills in Connecticut. The fabric end of the business will be handled by a new corporation recently formed under the name of the Goodyear Tire & Fabric Co.

The Late Tex Millman

Peter Carl Millman, better known as Tex Millman, a prominent aviator and instructor to the First Aero Corps, died on March 18 of pneumonia at 101 Jerusalem avenue, Hempstead, L. I. He became a flier five years ago when he was only seventeen years old. He entered the employ of one of the companies demonstrating aeroplanes near Hempstead as a mechanic's helper. Within a short time he give up that calling for the pilot's seat, and since then he had driven almost every make of machine and had flown in all parts of the country. He was known as a spectacular flier, but he never had an accident.

A year ago Millman entered the Government service as instructor to the First Aero Corps. Five months ago he married Miss Mary Schulz, of Hempstead.

A squadron of twelve aeroplanes of the First Corps flew over his grave in Westbury Cemetery just after he was buried and their pilots dropped flowers as a mark of respect. There was also laid on his grave a large floral piece, a tribute from the 200 employes at the aviation camp in Hempstead.

DETAILS OF THE RUMPLER BIPLANE

Following the description of the 1916 type Rumpler biplane, which appeared last week in Aerial Age, some of the prominent details are illustrated below. The drawings are from *L'Aerophile*.

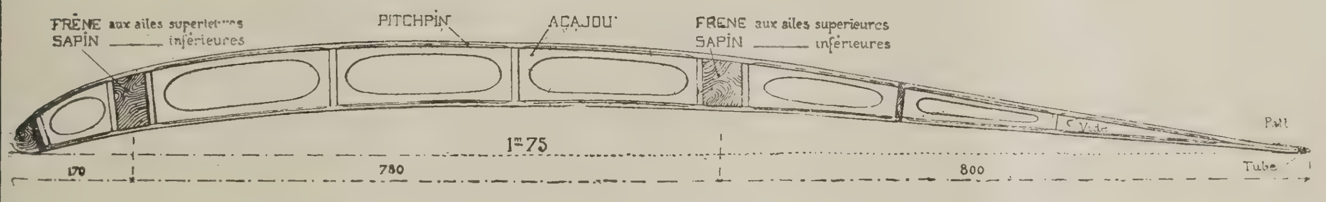
In the upper main plane the wing spars are of ash, and in the lower main plane they are of spruce. Flanges are of pitch pine, and webs of mahogany. The trailing edges are formed of steel tube.

Interplane struts are of tubular steel of streamline section. Near the ends they taper sharply and terminate in a ball which is slotted to receive an eyebolt which runs vertically through the wing spar. Struts are so pivoted on the eyebolt that when the cable is loosened they can pivot sideways and be slipped out from between the planes. Anchorage for the bracing cables consists of a hollow dome-shaped steel shell slotted in places to receive the turnbuckles.

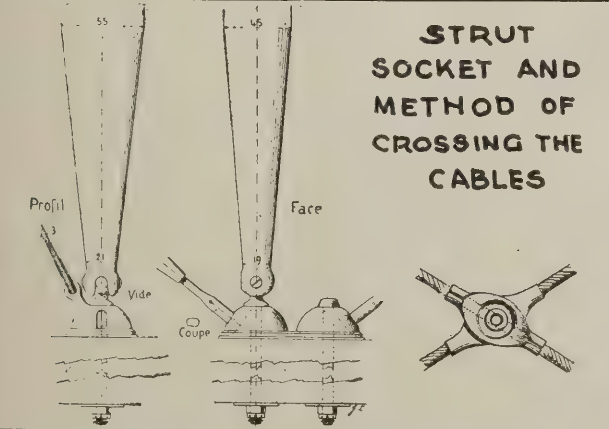
Vibration and friction is prevented where the bracing cables cross by the employment of a sheet metal clip composed of two parts held together with a rivet, one part clamping around each of the cables.

Attachment between the wing spars and the fuselage is quickly made. The spar end is provided with a duraluminin fitting, the hooked end of which fits into a cup-like receptacle which is incorporated in the longeron fitting. A single bolt holds the wing-fitting to the fuselage fitting. The drift cable turnbuckle is attached to this fitting.

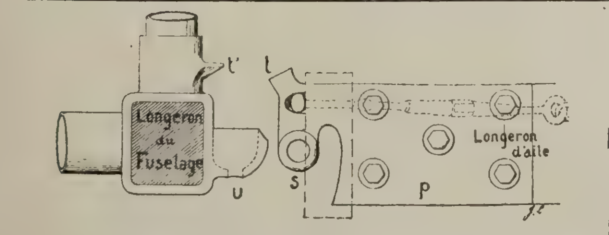
Cables are provided with fittings which permit them to be separated for dismantling the machine. These connections are of the button-and-groove type, which, when the cable is slackened, can be easily detached.



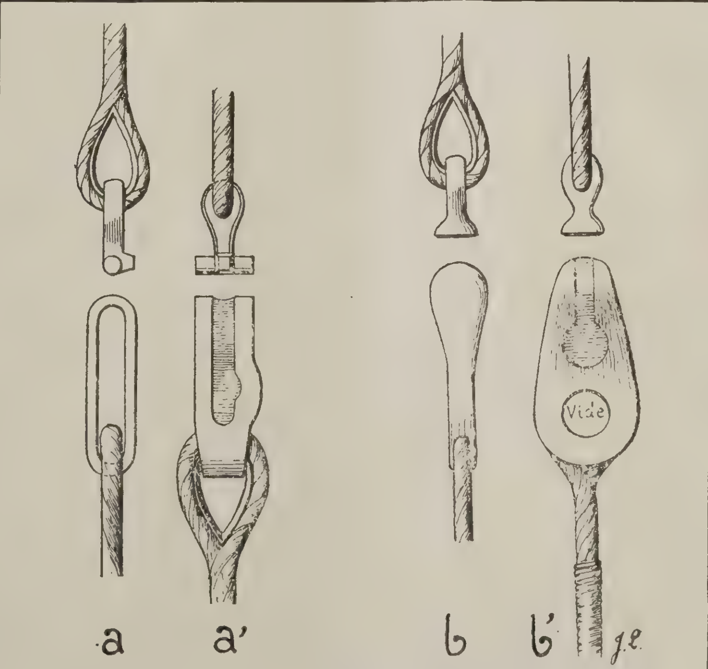
WING RIB



STRUT SOCKET AND METHOD OF CROSSING THE CABLES



ATTACHMENT OF WING BEAM TO BODY



TYPES OF RUMPLER CABLE JOINTS

THE STAGGER AND CAMBER OF BIPLANE WINGS*

By PAUL A. G. KAUFFMANN, E. S. A.

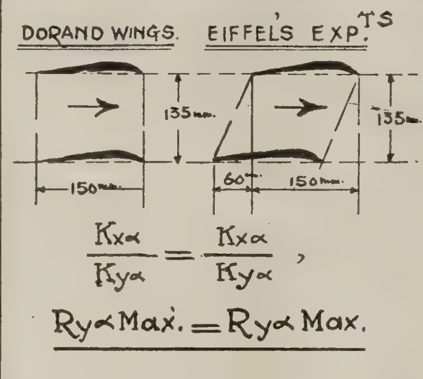
TESTS to determine the influence of longitudinally staggering the lifting surfaces of a biplane have been made at the Auteuil Laboratory with wings having the Dorand camber; it was found that when the upper surface of the biplane is staggered forward to the extent of 1/2.25th of the distance between it and the lower surface, this gap being 9-10ths of the chord of the surfaces, an increase of the lift-coefficient K_{ya} † of from 6 to 10 per cent. results; but the ratio $\frac{K_{xa}}{K_{ya}}$ remains the same, as is also the maximum value of R_{ya}. No great practical advantage is therefore, in this case obtained from the stagger.

M. Eiffel had previously tested a biplane consisting of two surfaces 90 × 15 cm., of circular curvature, with a camber of 1/13.5th of the chord, and a gap of 4-3rds of the chord; the top surface was staggered forward to an amount equal to its chord in one experiment and to half the chord in another; the ratio $\frac{K_{xa}}{K_{ya}}$ became better than that of a no-stagger biplane only when the value of the lift co-efficient, K_{ya}, was greater than 0.066, and then the improvement increased with the stagger; the maximum value of K_{ya} was improved by 5 per cent. in the case of the stagger equal to ½ the chord and by 10 per cent in that of the stagger equal to the chord of the surface.

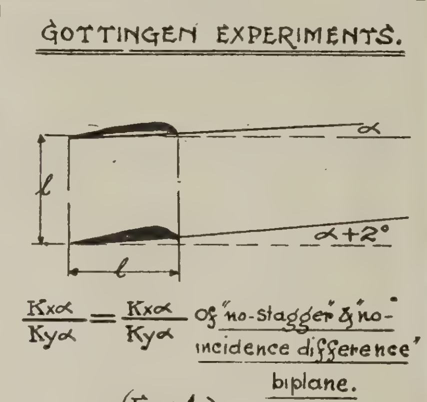
The National Physical Laboratory has found that with a Blériot curvature, of aspect-ratio 4, the lift co-efficient was increased from 5 to 6 per cent, and the lift-to-drift-ratio improved by from 1 to 4 per cent. when the upper surface was staggered forward to an amount equal to 1/2.5th of the gap, which itself was equal to the chord of the surfaces.

The Göttingen Laboratory has carried out a number of experiments by first placing the upper surface forward of the lower one, then exactly above, and finally behind it. In each case a series of experiments were made when the lower surface had, with reference to the upper surface, inclinations of + 2°, 0° and — 2° respectively.

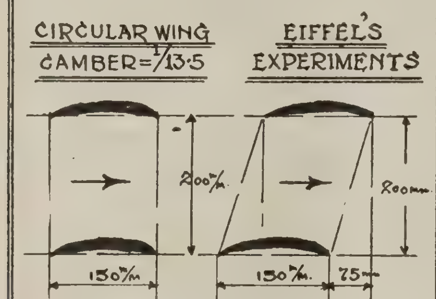
The amount of longitudinal stagger was + ⅔, 0, — ⅔rds of the gap which was equal to the chord, the curvature having a camber 1/20th of the chord in the case of the lower surface and of 1/14th of the chord in that of the upper surface.



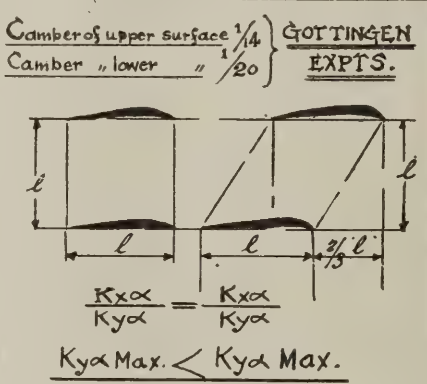
(Fig. 1.)


GOTTINGEN EXPERIMENTS.
α
l
α+2°
l
Kxα/Kyα = Kxα/Kyα of "no-stagger" & "no-incidence difference" biplane.

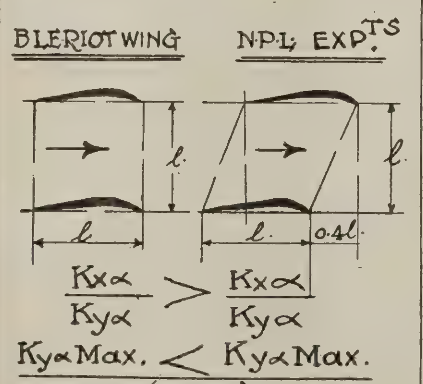
(Fig. 4.)



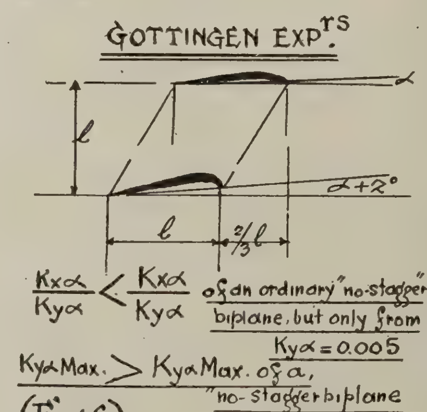
(Fig. 2.)



(Fig. 5.)



(Fig 3.)


GOTTINGEN EXPTS
α
l
α+2°
l
2/3 l
Kxα/Kyα < Kxα/Kyα of an ordinary "no-stagger" biplane, but only from Kyα = 0.005
Kyα Max. > Kyα Max. of a, "no-stagger biplane"

(Fig 6.)

When the longitudinal stagger is 0, no improvement was found by giving a greater incident to the lower surface; full-sized machines, on the other hand, have nearly all a better lift to drift ratio by the adoption of this device. (Fig. 4.)

No improvement was again obtained when the upper surface was staggered forward, the angles of incidence being the same: the lift co-efficient only increases 8 per cent. (Fig. 5.) When the upper surface is placed forward at an incidence greater than that of the lower surface, there is gain only from a given value of lift co-efficient equal to 0.055, this result being contrary to what seems to be the case when a study is made of the Sopwith, Nieuport, Deutsche, Flugzenwerke, Luftverein Gesellshaft, etc., biplanes. Besides, in this case, Gottingen finds that the maximum lift co-efficient is 9 per cent. greater than in the no-stagger biplane and 4 per cent. than that if the monoplane, a result which, at first sight, might appear astonishing. (See Fig. 6.)

Being given that the various experimental results relating to the simple longitudinal stagger and to angular longitudinal stagger do not agree with one another, it can be assumed that, to a great degree, the results obtained differ from one another on account of differences in the curvature of the surfaces. Besides, one should always consider a biplane as forming an aerodynamical whole which cannot be reduced to a simpler expression; it is therefore necessary to study separately each side of each of the surfaces.

In accordance with the lastest Auteuil experiments, the top side of the upper surface of a biplane is not influenced by the lower wing; it can, therefore, be looked upon as the top surface of a monoplane wing and be given a curvature similar to that employed for monoplanes—that is, one with a camber lying between 1/10th and ⅛th of the chord.

The under side of the upper wing and the top side of the lower wing influence each other; this interference may be considered as acting in two ways: it diminishes K_{ya} and increases $\frac{K_{xa}}{K_{ya}}$; it is this increase of $\frac{K_{xa}}{K_{ya}}$ that it is most important to suppress, while a small decrease of K_{ya} may perfectly be tolerated at small inclinations. If K_{xa} diminishes at the same time and in a similar manner, one could even say that this decrease is advantageous; in fact, at small angles a decrease of K_{ya} for a same angle and for the same ratio $\frac{K_{xa}}{K_{ya}}$ gives a more flexible polar curve (Fig. 7), since the maximum $\frac{K_{xa}}{K_{ya}}$ takes place in general from 2° to 5° at a lift co-efficient comprised between 0.02 and 0.04; and at great inclinations we have seen that Göttingen has shown an increase of K_{ya} *minimum*, and of the ratio $\frac{K_{ya}}{K_{xa}}$ for a K_{ya} greater than 0.05 (for a biplane with the upper surface forward, with — 2°).

With a view to reducing the interference of the under side of the top surface and top side of the under surface, one can try to give more or less camber to each of the sides facing each other; in order to achieve this purpose it should be remembered that the air arriving on a convex portion (back of wind, for instance), increases its speed; whilst on a concave portion, as that of the under side of a wing, the speed is much reduced.

In consequence, if a great camber is given to the under side of the upper wing, a considerable mass of air will be stopped by that camber, and the horizontal speed of the mass of air will be reduced, and a downward speed communicated to it. This mass of air will then considerably interfere with the top side of the lower wing; on the other hand, if the under surface of the upper wing is flat, or, still better, cambered in a direction inverse to the usual one (convex instead of concave), such an arrangement would facilitate the flow of air, and would even enable it to acquire additional speed; it would therefore increase the efficiency of the top side of the lower surface. It is true that, in the latter case, a certain amount of lift on the under side of the upper surface is lost: K_{ya} is reduced, but $\frac{K_{xa}}{K_{ya}}$ remains the same. (See Technical Report of Advisory Committee for Aeronautics, 1911-12.)

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* Translated from *L'Aérophile*, September, 1916. The author of the article, M. Kauffmann, is an engineer of the Ecole Supérieure d'Aéronautique, founded and ably conducted by Commandant Roche, who, when the Aeronautical Institute of Great Britain was founded, very kindly accepted to be on its Advisory Board, thereby giving it the benefit of his valuable experience.

† The symbol K_{ya} is adopted to denote the vertical or Y-component of the air co-efficient when the inclination of the surface is a. Similarly K_{xa} is used to denote the vertical or X-component for inclination a, and R_{ya} denote the lift.

THE LOWER SURFACE.

The top side of the upper surface, not being influenced, there is no reason to give it less curvature than that of a monoplane wing; on the contrary, having an angle of attack 2° greater than the upper surface, one can give it a greater camber.

The under side of the lower wing, not being influenced, can have the same camber as the under side of a monoplane wing.

The Caudron biplane belongs to a class of aeroplanes in which the flexible upper wing, not being interfered with, effaces itself in the wind to a greater degree than its lower wing, whose R_{ya} is reduced by the upper surface. M. Caudron has made experiments in which the angle of attack of its lower surface was increased by 1°, 2°, and 3° respectively; he has found that in none of these arrangements was there any advantage; from 4° the ratio $\frac{K_{xa}}{K_{ya}}$ was not so good. In the case of the Caudron the angular stagger was, to a certain degree, automatic.

M. Bréguet, in his former machines, with very flexible wings having one single spar, was, in order to have the least possible drift, obliged to give a greater incidence to the upper wing; the automatic angular stagger was in that case too large, on account of the extreme flexibility of the wings.

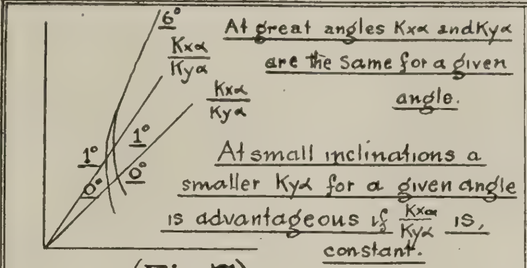
The new Bréguet machines, with rigid wings and two spars, have, like the majority of existing biplanes, more incidence at the lower wing.

When flexible wings are employed, it is therefore necessary to take into account the degree of flexibility of the wings, and the disturbance which the flexibility brings into the incidence of the various surfaces, once the machine is in flight.

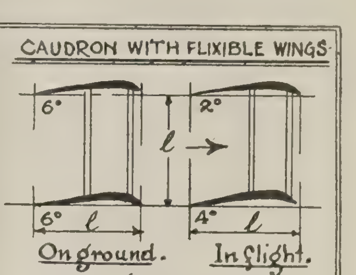
One can, therefore, conclude as follows:—

Give to the top side of the upper surface and to the under side of the lower surface the current monoplane curvature; to the top side of the under surface, a curvature somewhat larger than that of the top side of the upper surface; and, especially, to the under side of the upper surface no curvature or a slightly convex one; the lower surface lagging behind the upper surface, it should have a slightly larger angle of incidence.

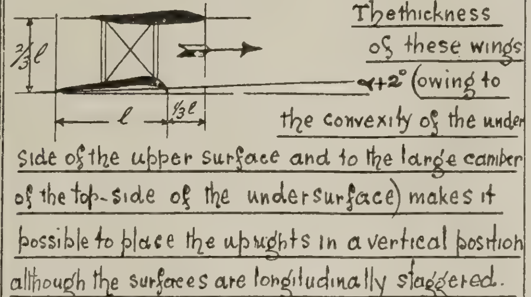
With flexible wings, the angular stagger of construction should be small, zero, or negative, according as the wings are rigid, flexible, or very flexible.


6°
$\frac{K_{x\alpha}}{K_{y\alpha}}$
$\frac{K_{x\alpha}}{K_{y\alpha}}$
1°
1°
0°
6°
At great angles $K_{x\alpha}$ and $K_{y\alpha}$ are the same for a given angle.
At small inclinations a smaller $K_{y\alpha}$ for a given angle is advantageous if $\frac{K_{x\alpha}}{K_{y\alpha}}$ is, constant.

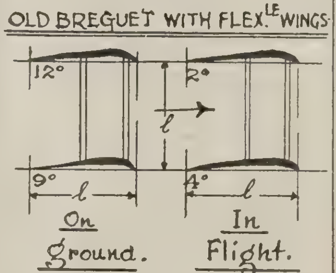
(Fig. 7.)



(Fig 9.)


$\frac{2}{3}l$
l
$\frac{1}{3}l$
The thickness of these wings
$\alpha+2°$ (owing to the convexity of the under side of the upper surface and to the large camber of the top-side of the undersurface) makes it possible to place the uprights in a vertical position although the surfaces are longitudinally staggered.

(Fig. 8.)



(Fig. 10.)

THE WOODWARD AERO NAVIGATOR

PATENTS have been granted to Mr. Charles D. Woodward, of Providence, R. I., for an invention whereby aero-navigation by using the shadows from the sun is made possible and extremely simple by a mechanical device. The device is really a mechanical sun dial, which, by its own clock works and other devices for adjustment to circumstances, points out and automatically corrects the points of the compass geographically, and not magnetically.

In the embodiment of the invention, use is made of two sets of clock hands and faces, one of which keeps Greenwich mean time and the other is adapted to be set to the local apparent time of the place of observation.

In connection with such clock mechanism, use is made of a style and of a graduated shadow-disk marked in the sun's degrees and also with points of the compass and connected with the clock mechanism for rotation in correspondence or agreement with the relative angular motion of the earth and sun and adapted to be set with reference to the sun's degrees, represented by the time difference.

In connection with the mechanism, use may be made of an index wheel that is of service in setting the shadow disk. The disk is constructed of frosted glass, so that its markings can be read from the bottom.

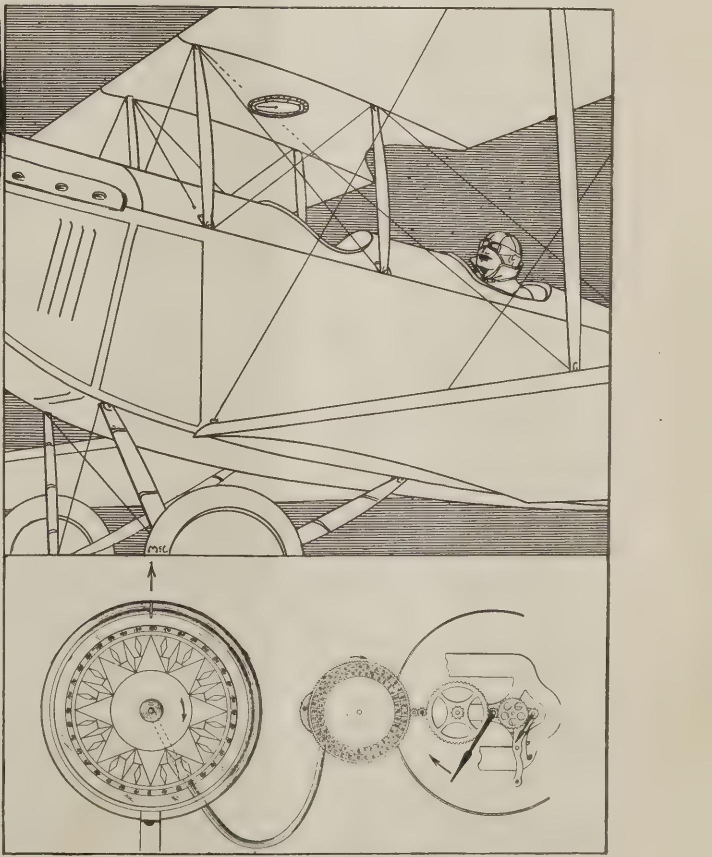
The lubber line in connection with the centre of the disk indicated the fore and aft direction. The clock hands are driven from the same clock mechanism as is also the disk by means of a shaft, which may be flexible.

The disk is arranged above the aviator so that he can conveniently read it from the bottom. If the aeroplane is at rest, for example, on the ground in a certain locality and is facing north, although that fact may not be known to the aviator, then at noon in that locality the shadow cast by the style on the disk will lie due north and south, so that the shadow will indicate 180 on the disk and also the marking indicating north.

The aviator by reference to the shadow reads the marking for north and ascertains that he is facing north. As time goes on the disk is turned clock-wise at the rate of one revolution in twenty-four hours and its degree corresponds with the sun's degree, so that if after some time has elapsed the shadow be again referred to it will still indicate the north marking on the disk, since that marking has traveled through the same number of degrees as indicated by the relative travel of the sun and earth

It is evident that if the aeroplane instead of remaining still had turned around more or less, it would have turned the disk and the lubber marking collectively, but not in respect to each other, so that in these circumstances reference to the shadow and the marking which it indicates on the disk afford means for ascertaining the direction in which the aeroplane is pointed, and of course generally indicated the points of the compass.

After the apparatus has been thus set it will continue to run, and an observation of the shadow in respect to the disk affords means for determining direction, as has been indicated, and also means for determining the exact geographical position of the aeroplane because it gives the sun's true bearings.



The Woodward Aero Navigator.

FOREIGN NEWS

AUSTRIA-HUNGARY

"Automobile and aeroplane motor manufacturers in Hungary have formed an organization as a subdivision of the National Union of Hungarian Manufacturers," says a consular report. "Prior to the war the automobile industry was not flourishing, but war orders have greatly strengthened it, and the association just formed is for the purpose of protecting the interests of the manufacturers and for dealing with questions that will come up after the war, also during the war, to represent the manufacturers at the Ministry of War.

"Among the questions to be considered for business after the war will be import duties on automobiles, an agreement between factories as to types of cars to be manufactured, and the disposition of the large number of cars that have been used in the war and that will be on the market afterwood. It is possible that American methods will be followed and quantity production of motor cars begun."

FRANCE

PARIS, March 17.—Capt. Georges Guynemer demonstrated again yesterday his claim to be the world's premier aviator by dashing three German machines to earth in three combats in one hour.

This intrepid, slightly built youth, who travels in the fastest man-made vehicle ever constructed, took the air after several weeks of resting and immediately apprised the enemy of his presence.

Climbing to a tremendous altitude, he set sail for the inside of the German lines, as it is useless for French aviators to await the Germans, who never leave the protection of their Krupp anti-aircraft guns.

When well inside the German lines Guynemer darted after a big two-gun Fokker, keeping above it, so that the German machine guns were useless, and sniping off both its wings with his own mitrailleuse. After the Fokker was smashed, he turned the nose of his craft upward, his terrific momentum defying gravitation, and bagged the second German machine from below in his own private fashion—shooting through the floor of the enemy machine. This endangers him, as the other aeroplane is likely to fall upon him, but Guynemer has escaped so far.

The third German was destroyed when he tried to lure Guynemer down within range of the anti-aircraft guns. The Frenchman pretended to start into the trap, then suddenly quickened his speed and shot the enemy machine to pieces before the latter had time to turn and fire back.

Guynemer has now brought down thirty-four machines and easily the foremost military aviator in France. Only twenty-two years old and making a meteoric rise from a simple soldier two years ago to the rank of Captain in the Flying Corps, he has won the Legion of Honor, the Military Medal, the Croix de Guerre and every other honor which an admiring nation can bestow.

GREAT BRITAIN

It has been officially announced that the following is the composition of the British Air Board:—

President, the Rt. Hon. Viscount Cowdray.
Parliamentary Secretary, Major J. L. Baird M.P., C.M.G., D.S.O.
Fifth Sea Lord of the Admiralty, Commodore G. Paine, C.B., M.V.O.
Director-General of Military Aeronautics, Lieut.-General Sir David Henderson, K.C.B..
Controller of Aeronautical Supplies, William Weir.
Controller of Petrol Engines, Percy Martin.
Secretary, Sir Paul Harvey, K.C.M.G., C.B.
Assistant Secretary, H. W. W. McAnally.
Private Secretary to the Parliamentary Secretary, G. G. Evans.

The formation of the new Air Board is authorized by an Order in Council published in the "Gazette" of Feburary 6th, as follows:—

1. The Air Board shall, until it is by Order in Council otherwise directed, consist, in addition to the President, as follows:—
   (a) A Parliamentary Secretary of the Board;
   (b) The Lord Commissioner of the Admiralty who is charged with the direction of the Naval Air Services;
   (c) The member of the Army Council who is charged with the direction of Military Aeronautics;
   (d) The Controller of Aeronautical Supplies and the Controller of the Petrol Engine Department, of the Ministry of Munitions;
   (e) Additional members as may from time to time be found desirable.
2. In the event of one or other of the officers named under the letters (b), (c), (d) above being unable to attend a meeting of the Board, the Department to which he belongs may designate an officer to attend in his place.
3. Members of the Air Board other than those who are appointed in virtue of the holding of certain offices shall be appointed by the President of the Board.
4. Members of the Air Board appointed in virtue of the holding of certain offices shall continue to be members of the Board so long as they hold those offices. Members appointed otherwise than as aforesaid shall hold their appointments at the pleasure of the President of the Board.
5. This Order may be cited as the Air Board Order, 1917.

LONDON, March 13.—James Ian Macpherson, Parliamentary Secretary to the Under Secretary of State for War, replying in the House of Commons today to a question voicing recent criticisms of the British Air service and suggesting that the British no longer maintained the mastery of the air on the western front, said:

"We are satisfied with our best type of flying machines at the front. Some machines which are not up to standard are being replaced as rapidly as possible."

The average weekly air casualties for the last six weeks, Mr. Macpherson said, had been: Killed, 7.6; wounded, 8.3, and missing, 4.2.

"The situation in the air," the Parliamentary Secretary continued, has not yet been decided. During the Winter all the belligerents endeavored to improve and to increase their air services. With the advent of good weather severe contests must be expected before definite superiority is achieved.

"In one respect the British always have been superior to the Germans, namely, in the amount of work performed by the flying corps for the army. The situation is very similar to that obtaining in the same period last year, when the Germans, rested and reinforced after the Winter, put up serious opposition, and only after severe fighting was the British superiority established.

"This year the German concentration appears to be on the front of the British. The move probably is connected with the German retirement. Reinforcements and replacements are continually being sent to the front, and there is every reason for hope that the British again will assert their superiority."

LONDON, March 17.—Another Zeppelin raid on London, the first since November 27, ended last night in disaster for the German airships. Apparently while the raiders were returning to their base one of them, flying at a height of more than two miles over the Somme battlefield in France, was sighted by anti-aircraft batteries and was brought down to earth with a shock that split it in two.

The attack on London, details of which are withheld, caused little or no excitement, even among returning theatregoers. Favored by a dark and moonless night, the Zeppelins first appeared over the south-eastern counties of England, where twenty-seven bombs are reported to have been dropped on the rural districts, without inflicting much damage.

The raiders are believed to have reached London just before midnight.

SIGHTED NEAR THE SOMME

Returning homeward, the great airships passed fairly close to Paris about 4:15 this morning. At that time firemen went through the streets of the French capital extinguishing lights and warning the residents by blowing sirens. At 6 o'clock it was announced that all danger was over.

Shortly before dawn French gunners near Compiegne, forty-five miles northeast of Paris and almost on the Somme battle line, sighted one of the Zeppelins. The first shots from the anti-aircraft batteries reached the airship, which was nearly three miles up. It suddenly burst into flames, remained poised in the air a moment and then crashed to earth. Striking a garden wall, it broke in two, a mass of wreckage from which the burned bodies of thirty of the crew were afterward extricated.

As the airship fell, leaving a trail of fire from the blazing fragments of the envelope, several of the crew jumped out of the gondolas, all of them being crushed to death as they struck the earth. The remaining bombs in the Zeppelin were thrown out as the airship descended, most of them striking in the open fields and failing to explode. The Zeppelin was later identified as the L-39.

Airmen returning from France report that the Germans are using new methods of combating the British airmen. Hitherto it has been possible for the British aviators to patrol over the important German positions by making squadron flights, the Germans using scattering anti-aircraft fire.

Now the Germans concentrate their anti-aircraft guns on given areas, forcing the British aviators to go through a withering fire if they wish to reconnoitre the positions.

Lieutenant Vernon C. Blythe, of the Royal Flying Corps, has received the Croix de Guerre for valorous action on the Western front.

Lest a world satiated with daring deeds and military crosses should yawn and refuse to read past the first paragraph, let it be added at once that Mrs. Vernon Castle made this announcement.

Lieutenant Blythe is known in a land that pays more attention to dancing than to aeroplanes as Vernon Castle. According to his wife, the little cross on his breast means that he has brought to earth two German fighters.

"Vernon had three weeks' leave in London," Mrs. Castle said. "We were together all the time, but we didn't dance. Officers are not allowed to dance in England any more. He looked well and happy, and he is back on the French front now, winning more crosses, I hope."

HOLLAND

AMSTERDAM, March 15.—A German aeroplane which flew over Sluis was shot at and hit by Dutch troops who were manoeuvring in the neighborhood, according to the Handelsblad.

The aviator was wounded and compelled to descend in Dutch territory, but before he could be overtaken by the Dutch soldiers, he restarted his machine and flew three hundred metres over the border into Belgium. German troops hurried to his rescue and he was carried away by Red Cross attendants.

JAPAN

From "Japan Times" February 8

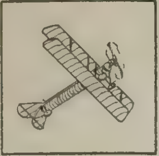
Major Isobe who is attached to the French aviation corps is now taking an active part in aerial warfare somewhere near the Verdun theatre of war, according to his recent letters. After one year's volunteer service at the front, Major Isobe returned some time ago to Paris to take a rest-cure, but being restored to health and strength he again proceeded to the front on January 13. He is one of the veteran Japanese flyers and is said to have a good command of looping the loop which he has learned in France.

From "Japan Times" February 10

Dr. Kishi's new aeroplane No. 3 "Tsurugi" which has been completed recently will be piloted by Lieutenant Inouye on February 10 and 11. The flights will be made at the reclaimed ground at Susaki, Fukagawa. The new machine is the third aeroplane constructed by Dr. Kishi who is an earnest student of aeronautics, all his machines have been made of Japanese materials entirely.

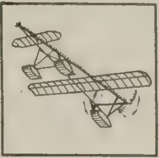
Flights for army officers have been arranged for Saturday and Sunday from Tokorozawa, past Hachioji in the suburbs of Tokyo, over Obosatsutoge (a mountain, 2,000 metres above the sea level) and Mt. Enzan to the city of Kofu, in Yamanashi prefecture. Thence to Lake Suwa in Nagano prefecture. Two Morris-Farman aeroplanes will be used. The chosen pilots are Lieuts. Makabe and Takikawa. They will start from Tokorozawa at 8:30 on Saturday morning for Kofu, where they will make a stop at the parade ground of the Kofu regiment. After an hour's rest the two flight officers plan to set out for Suwa in Nagano prefecture. On the next day they are expected to fly above the frozen surface of Lake Suwa.

On the return journey, it has been arranged that Lieuts. Nagasawa and Nakada will relieve their comrades and attempt a non-stop flight to Tokorozawa.



MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th Street, New York City

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.

LONG ISLAND MODEL AERO CLUB
401 Grant Avenue, Cypress Hills, L. I.

BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn

YOUNGSTOWN MODEL AERO CLUB
924 Wabash Ave., Youngstown, Ohio

DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.

BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge Street, Buffalo, N. Y.

THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

TEXAS MODEL AERO CLUB
517 Navarro Street, San Antonio, Texas

SPRINGFIELD MODEL AERO CLUB
47 Churchill St., Springfield, Mass.

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Kite Flying at the Drexel Aerological Station, by the Aerological Division, Wm. R. Blair in Charge

A photograph showing the relative location of the Drexel farm buildings and the ground used as a kite field will be shown in a forthcoming issue of AERIAL AGE. The lease for the property went into effect a short time ago, and the work of installation of the kite flying and other equipment was immediately begun. The granary was modified to accommodate the carpenter shop, a small testing room for calibrating and testing meteorographs, a small machine shop for repairs to apparatus and machinery, a power plant room containing the gasoline engine, generator, and switchboard for the distribution of electric current, and storage room for kites.

The carpenter shop is completely equipped for the building and repair of kites. The power plant consists of a 250-volt, 5-kilowatt generator, directly connected with a 4-cylinder gasoline engine. The power generated is used to operate the kite reel, also the saw table of the carpenter shop, the lathes and drill press of the machine shop, and for lighting the shops and the reel house when kite flights are being made at night.

The wind tower, instrument shelter, rain and snow gages were completely installed and observations begun. The concrete foundations for the track of the reel house could not be laid until 1915. The superstructure of the reel house, the installation of the power plant and all wiring were completed and the first free-air record obtained on October 22, 1915. Daily free-air observations were begun December 1, 1915, twenty-eight observations having been obtained during October and November, 1915.

The track and rollers for the reel house, all equipment for the carpenter and machine shops, kites and power reel, calibrating apparatus, wind tower, and other equipment for the observation of surface meteorological conditions, horse and wagon, and furniture for offices and quarters were shipped to the Drexel station from Mount Weather, Va., in the autumn of 1914 and later.

The Drexel station is 396 meters above sea level, 41° 20′ north latitude and 96° 16′ west longitude. The kite field is comparatively level, extreme variations in its level being less than 3 meters. The station is about 32 kilometers west of Omaha; 8 kilometers from Elkhorn, Neb., the nearest station on the Union Pacific Railroad, and an equal distance from Washington, Neb., the nearest station on the Chicago & Northwestern Railroad. Mail reaches the station daily by rural free delivery from Washington, Neb. Freight, express and telegrams are best sent via Elkhorn, Neb.

Photographs showing the farm buildings and their environment, the beginning of a kite flight, and a near view of the reel house showing the reel, will appear in a forthcoming issue. The apparatus for turning the house on its track, and the instrument shelter in which the kite meteorograph is exposed, along with standard instruments before and after each flight. The reel house fronts away from the wind during a flight, consequently the instrument shelter is so located as to be well in the surface wind. An open roof above the shelter protects it from heat that might be reflected to it by the side of the reel house near which it is exposed. A small reading telescope mounted in the reel house enables the observer to read conveniently the instruments exposed in the shelter. It shows the variable speed motor by which the reel is driven and, in part, the method of insulating the reel from the reel house and from the power system. This insulation enables the observer to read the difference in electric potential between the kite and the earth at any time. The motor switch, starting and reversing box, clutch lever, speed variation, brakes, dynamometer, and line meter are all brought to the right side of the reel and may be conveniently operated or read by the operator without change of position. The drum of this wheel has a capacity of about 14 kilometers of piano-wire line.

The country surrounding the Drexel Aerological Station is level or somewhat rolling, nowhere deeply cut by creeks or rivers. Practically all land in this vicinity is under cultivation. Kites that break away are quickly found and returned to the station. A preliminary study of the data being obtained indicates that valuable results for dynamic meteorology are likely to accrue from free-air observation at this and prospective stations located in the open plains of the Middle West.

The Aero Science Club of America

Before the issue of this edition of AERIAL AGE the Aero Science Club of America will have held its first banquet in commemoration of the progress made by the club. There is no doubt but that the affair will be a success; a large number of tickets having been disposed of to a large majority of out of town members as well as to resident members. Every effort was made by the committees in charge to insure the success of the banquet.

The model aeroplane season is about to begin and many contests are planned to take place although no definite dates have been arranged. The banquet marks the beginning of activities on the part of the Aero Science Club and there is every indication that the coming year will not have passed without the establishment of many new records.

Y. M. C. A. Model Aeroplane Activities

Under date of March 13th, George A. Cavanagh delivered a lecture on "The Advantages of Model Flying" before a large gathering of young men associated with the Eastern District Y. M. C. A. of Brooklyn. By the use of motion pictures and slides the speaker was enabled to clearly demonstrate the wonderful progress of aeronautics both in this country and abroad. The young men present displayed considerable interest in the subject and at the conclusion of the lecture many expressed their desire of becoming members of the Model Aero Club of the Y. M. C. A. Mr. Cavanagh also spoke before the members of the Model Aero Club of the Y. M. C. A.

Model Aero Club Formed in Ithaca High School

At the meeting of the newly formed Aero Club at the High School, officers were elected as follows: President, Frederick Wilcox; vice president, George Vivian; secretary, C. Osborn Macky; treasurer, Lawrence Doll.

The Aero Club is co-operating with the Thomas Brothers Aeroplane Company and plans are under way to arrange a series of talks by Mr. Thomas and members of the company for the benefit of the club. Mr. Lyke, who is chairman of the club and who is also connected with the industrial arts department of the High School, will take the members of the club through the Thomas factory in the near future.

Contests are to be held in the High School gymnasium. The winners will challenge the aero clubs of other cities. Any one in the High School above the eighth grade interested in aerial work will be welcomed into the club.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Seidlitz Five-Stroke Engine

By GERALD DE LETTGO WOOD, in *Flight*

Those of you who went to a decent school, and have forgotten Ovid, will recall the story of Capaneus, the noble but plucky Argive, son of Hipponous and Astinome, and husband to Evadne. When he went to the war he had the temerity to declare that he would take Thebes in spite of Jupiter. Such impiety could only be rewarded by a thunderbolt; but we are told that the body of Campaneus was burned separately from others, and his wife threw herself on the burning pile to mingle her ashes with his.

As to whether Popaufkwick, the eminent Greenland municipal engineer, ever studied Latin we do not know, or does it greatly matter, but that some such idea as that with which the above story ends was present to his mind was evident. Confronted by the problem of designing an engine for the unique machine by which his dear friend, Dr. Chef, expected to reach the Pole, he saw at once for so noble a work it was essential that he should start *ab initio* and, throwing all accented principles to the winds, conceive something entirely original. As one of the three men in the world who had solved the insurmountable difficulties of using quicksilver for drop-forgings, he decided that the engine must have bearings of this type, rabbit lined. (*We fail to see where there was any trouble in this matter, for Greenland is near the Bearing Sea. After looking up our map of the world, we have decided that the joke is rather far-fetched.—Ed.*)

Having proceeded thus far, it became apparent that he should think of the fuel which should be used, and at once, in view of the coldness of the atmosphere in which the engines would have to work, he discarded any and every form of heat engine. Gasoline and steam were, of course, not to be thought of as they had been used before. How he solved the problem is a story which should be entrusted to an abler pen than that of such a humble scribe as the writer, for it is an epic in itself.

One fine afternoon, while indulging in his customary stroll after his matutinal meal, his eyes wandered from the etheral dome of heaven to the snowy mantel which enveloped the whole landscape. As he strolled, he found himself repeating, "Blue and white, blue and white," and at the twentieth repetition he cried, "Ah," in Esquimaux. The natural phenomena spreading itself around had quickened within his brain the germ of an idea. Popaufkwick at once bethought of that excellent hydragogue cathartic named after a little village in Bohemia. His new engine would be of the effervescent or bubbling type.

Vir sapit qui pauca loquitor

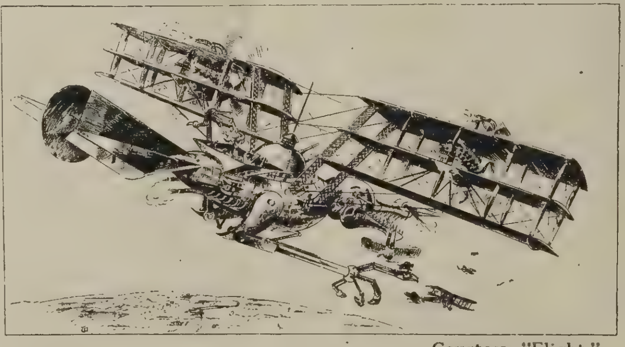
It will at once be recognized that the Pole being a fixture it was not likely to move, and *per se* there was no hurry. Why not, therefore, have a slow-running engine? On returning to his office the remaining details were quickly thought out. So far he had not come across a five-stroke cycle engine, *ergo,* the new engine must operate on the five-stroke cycle. It may be as well, before proceeding further, to enumerate the successive phases of the cycle. The cylinder being oscillating, as the piston goes downwards and the cylinder being inclined to one side, the Esquimauchanic in charge administers a blue packet; then on the piston coming up and the cylinder being diverted in the opposite direction, a white packet, according to directions, is added. Now, as the piston approaches the top of its stroke a valve opens, whereupon a spray of fine ammonia mingles the two powders and the resultant release of gas forces the piston downwards. So far we have traced the working of the engine through three successive strokes of the cycle; the fourth stroke is easy—it is none other than exhaust—but of the nature of the fifth, which is essentially in effect a double stroke, I cannot, for obvious reasons, divulge any further particulars. The process of reversing is delightfully simple; all that is necessary is for the Esquimauchanic to forget the scriptural injunction not to let his right hand know what his left hand doeth, and reverse the order of the packets, when the engine will naturally proceed as desired. Beyond stating that the shafts are made of cold drawn walrus tusks there remains very little more to be said about the engine.

(*To be continued indefinitely* [*perhaps.*—Ed.])

Our Own Specifications

(*Editor's Note.*—We found this article on the desk of one of our proofreaders. He had just finished tabulating the specifications and requirements for dirigibles of eighteen countries, and we fear that his mind was affected from wading through six hundred pages of technical data.)

1. All bids must be in the day before they are due or the bidder may have to pay some penalty for being late.
2. Kindly send on no drawings ahead of time because we are liable to get them mixed up.
3. After bids are awarded to the winning firm, eight of our inspectors, who know absolutely nothing about balloons, will be sent to each factory to see that no materials not up to our standards are used. These inspectors will have the final say in all disputes. If the contractor objects to their decision he can write to us, but absolutely no attention will be paid to the letter.
4. After the dirigibles are constructed we *may* buy them, but we guarantee nothing.
5. Nothing in paragraph 4 is to be construed as a contract.
6. If the finished machine weighs more than we think it should, we retain the option of, 1, refusing to accept the machine; 2, taking it but not paying for it. (In most cases the latter method will be followed.)
7. Nothing in paragraph 6 is to be construed as a contract.
8. For every day in advance of the stipulated time that the machine is completed the contractor will have our heartfelt thanks, but we will exact a penalty of one hundred dollars a day for each day beyond the specified time.
9. The successful bidder must agree to split fifty-fifty with the inspectors.
10. However, we reserve the right to change our mind at any time and stop work on the machines in which instance the contractor will be thanked for his pains.
11. Nothing in any of the above paragraphs is to be construed as a contract.



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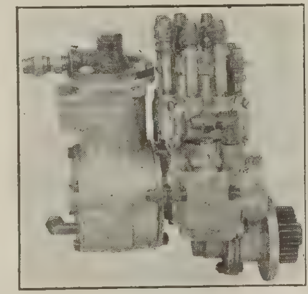

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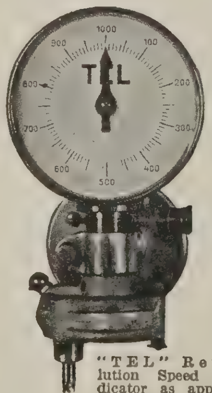

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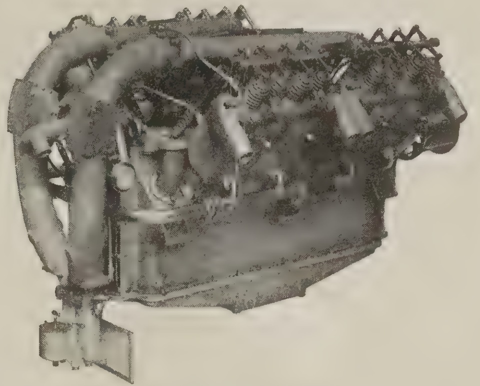

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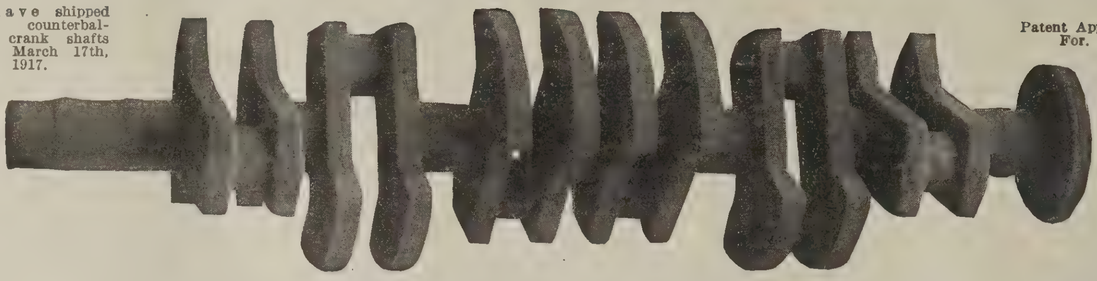

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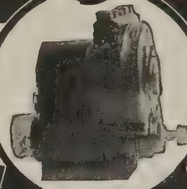

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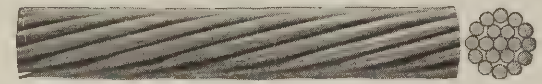

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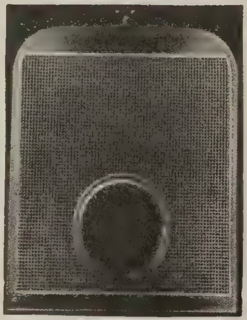

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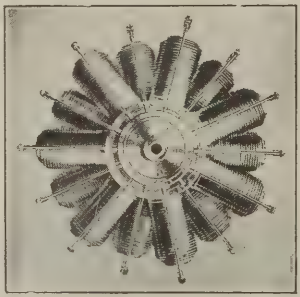

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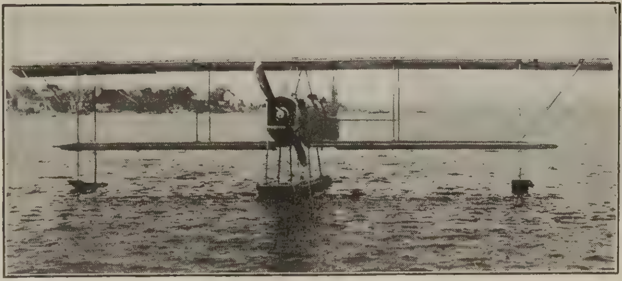

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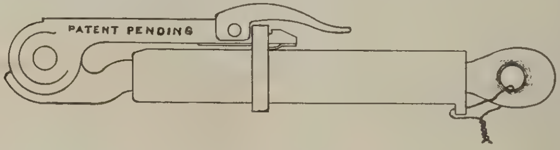

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The Erie Specialty Company is now supplying Screw Machine Products and Aluminum Castings to the leading aeroplane companies:—the aeroplane companies which desire the finest fittings and special parts that modern science and skill can produce.

Every part that leaves the factory of the Erie Specialty Company is tried, tested, and proved perfect.

We shall be glad to hear from those manufacturers of aircraft whose desire is for Screw Machine Products and Aluminum Castings which are accurate, strong, and efficient. Tell us your requirements and we will submit estimates and early delivery dates.

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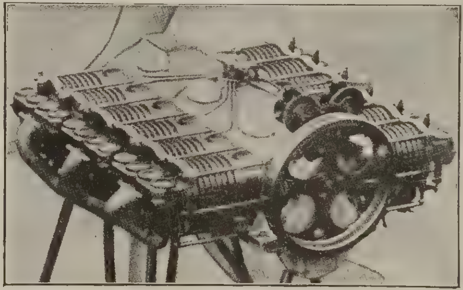

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

ASHMUSEN HIGH GRADE POWER PLANTS

ARE NOW READY FOR THE MARKET

Patents allowed and pending.

They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
Ignition—High Tension Magneto.
Carburetor—Improved ASHMUSEN.
Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11½ Gals. per hour, Low Grade.
Oil Consumption—70 H.P.—¾ Gal. per hour, Good Grade.
Oil Consumption—105 H.P.—1¼ Gals. per hour, Good Grade.

ASHMUSEN MFG. CO
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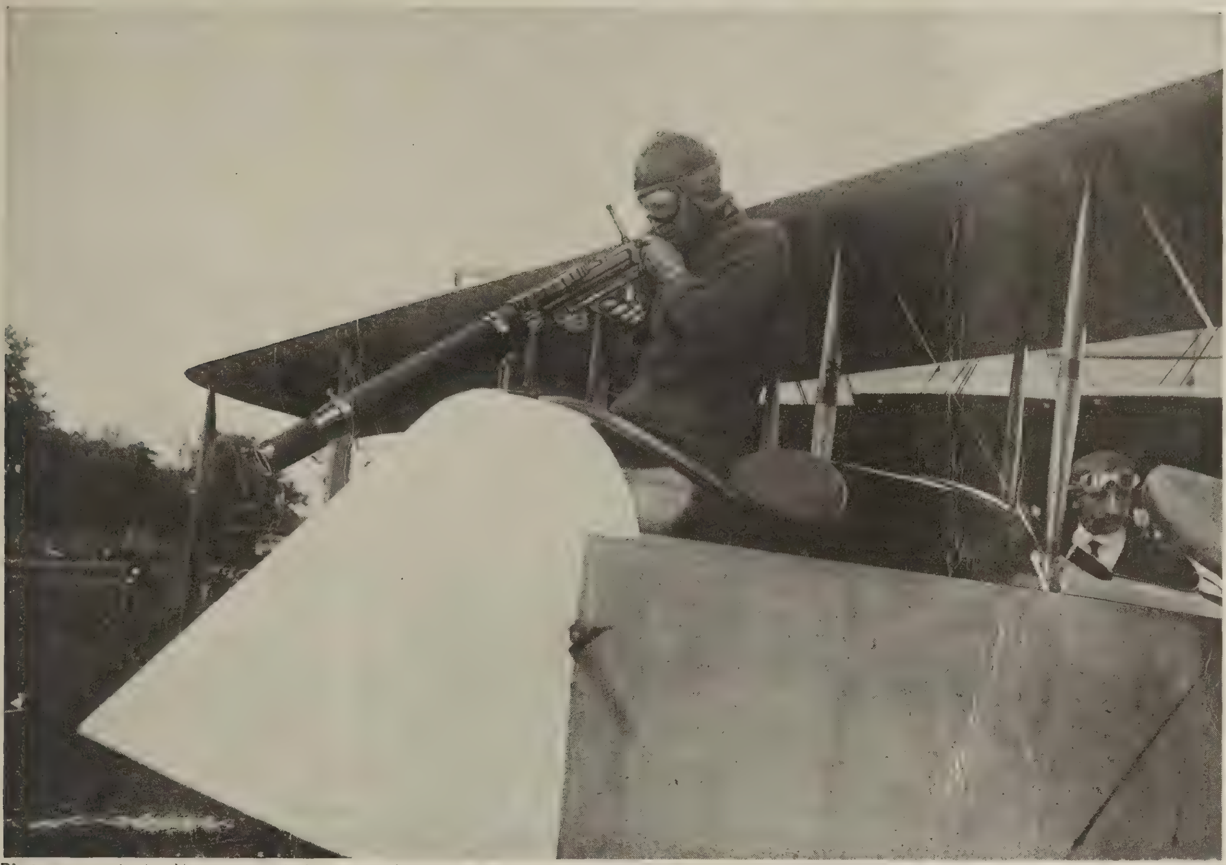


Photo copyright by Underwood & Underwood

Battleplane with Lewis Machine Gun mounted on bow of car. This plane was the first of its kind in the world

"In my private opinion the Lewis Machine Gun is the best light type gun yet developed for troops in the field."

Major-General LEONARD WOOD,
Commander of the Department of the East.

General Wood stated he "favored having . . . a reserve supply of 25,000 machine guns as in the end one in ten men will carry a 26 lb. machine gun as he now carries a rifle."

Statement made by Major General Leonard Wood testifying before the Military Committee of the House of Representatives reported in New York World, January 28th, 1916.

SAVAGE ARMS COMPANY

Executive Offices: 50 CHURCH STREET, NEW YORK
Factories: UTICA, NEW YORK

AVIATION TRAINING

THE CURTISS School of Aviation will give training this winter, in Florida, to those civilians who may be accepted by the Aviation Section, U. S. A., upon their having made application for enlistment in the Aviation Reserve Corps. Applicants must be between twenty-one and twenty-seven years of age, possess good health, character and college education or equivalent. Tuition will be paid by the Government.

FOR FURTHER INFORMATION WRITE

THE CURTISS TRAINING SCHOOLS

CHURCHILL STREET, BUFFALO, N. Y.

Curtiss

Military aviation training under Aviation Section United States Army supervision at our established schools at Newport News, Va., and Miami, Fla.

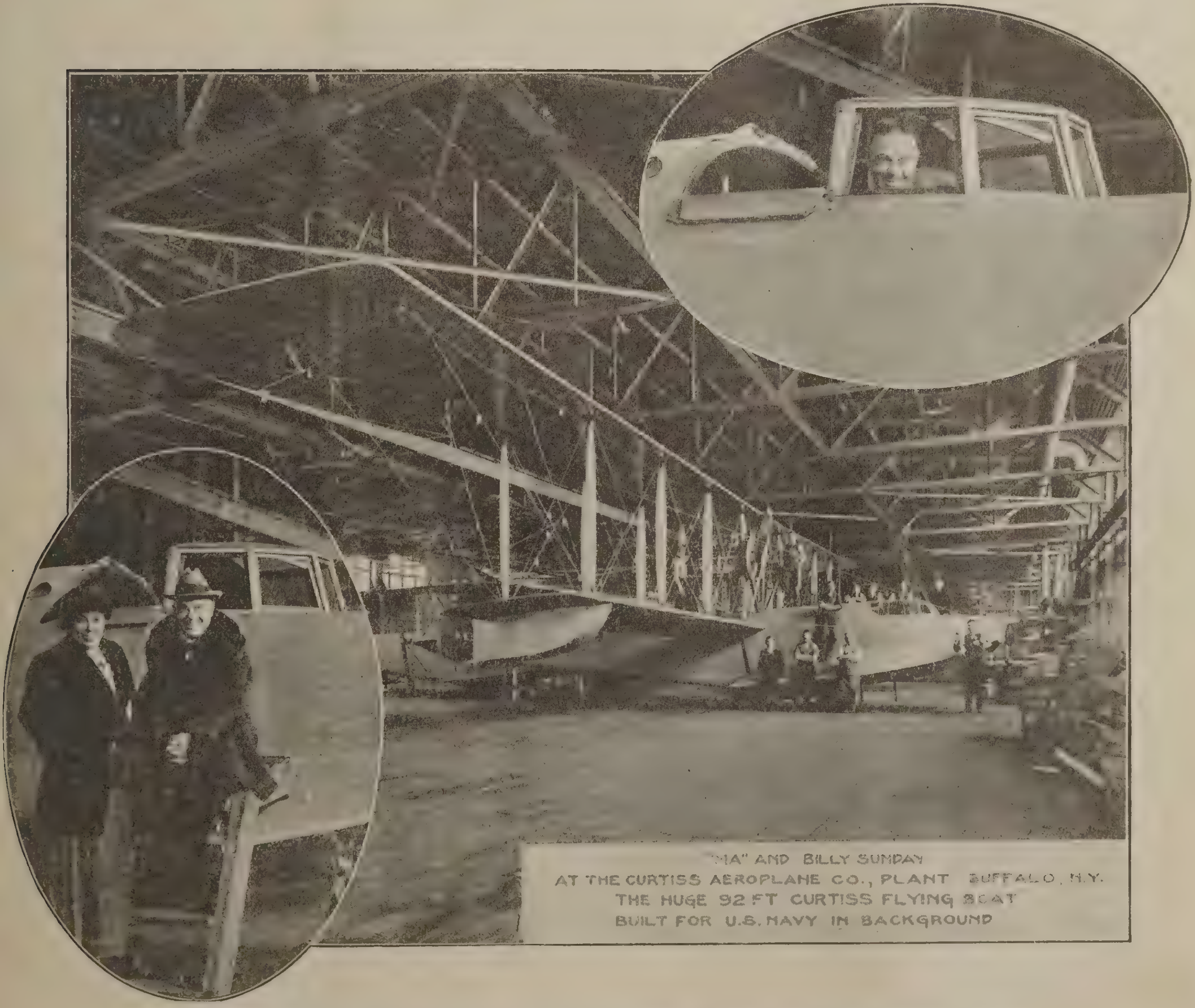
Curtiss

CAREY PRINTING COMPANY, INC.

AERIAL AGE
WEEKLY

Vol. 5, No. 3 APRIL 2, 1917 10 CENTS A COPY

4,000 AEROPLANES FOR ARMY AND NAVY

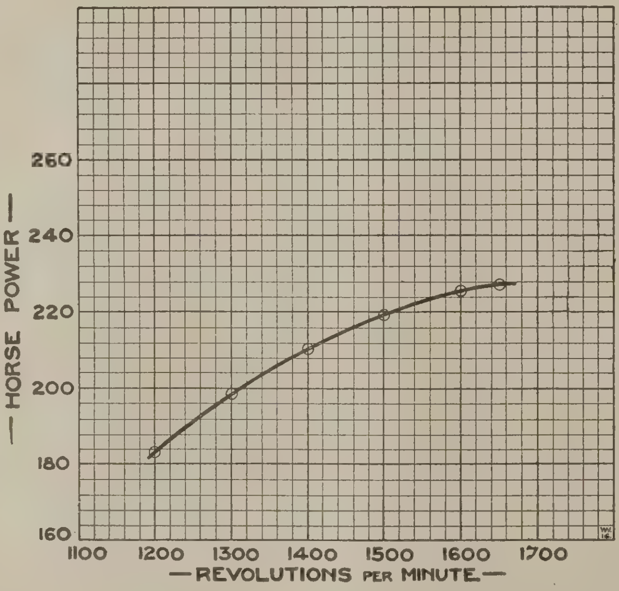

"MA" AND BILLY SUNDAY
AT THE CURTISS AEROPLANE CO., PLANT BUFFALO, N.Y.
THE HUGE 92 FT CURTISS FLYING BOAT
BUILT FOR U.S. NAVY IN BACKGROUND

"Ma" and Billy Sunday Inspect the Huge Curtiss Flying Boat Built for the Navy.

Curtiss

MODEL VX-3 motor was used by Victor Carlstrom on November 2nd in flying from Chicago to Erie, Penna., a distance of 452 miles, in 3 hours 57 minutes.

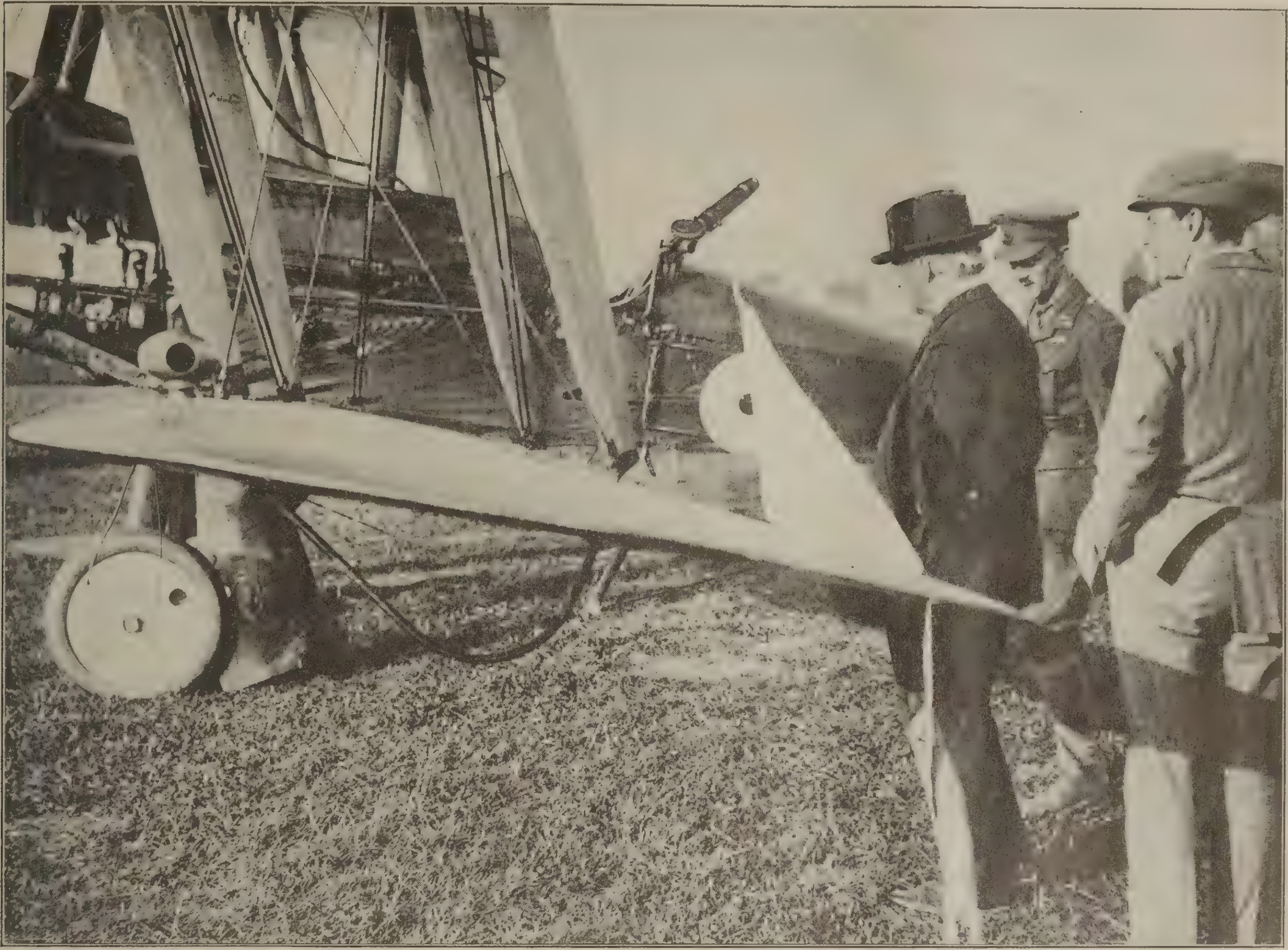
Owing to changes and improvements our 5″ x 7″ eight-cylinder motor, formerly known as Model "VX," rated at 160 horsepower, will hereafter be known as Model "VX-3" and will be rated at 200 horsepower. The following is a record of electric dynamometer test of stock motor "VX-3" No. 3512 as delivered from the Production Department:



Duration of Test	1 hr.
Average R. P. M	1403.33
Average Load on Scales (Lbs.)	449.64
Average Horse Power	**210.26**
Maximum Observed H.P. at 1400 R.P.M.	210.50
Minimum Observed H.P. at 1400 R.P.M.	208.10
Total Gas Consumption (Lbs.)	111.30
Total Gas Consumption (U. S. Gals.)	18.10
Gas Consumption Per Hour (Lbs.)	111.30
Gas Consumption Per Hour (U. S. Gals.)	18.10
Gas Consumption (Lbs. per H. P. Hour)	**.528**
Total Oil Consumption (Lbs.)	6.50
Total Oil Consumption (U. S. Gals.)	.844
Oil Consumption (U. S. Gals. Per Hour)	**.844**
Oil Pressure Start of Test (Lbs.)	71.00
Oil Pressure End of Test (Lbs.)	72.00
Oil Pressure Maximum (Lbs.)	74.00
Oil Pressure Minimum (Lbs.)	68.00
Average Inlet Water Temp. (F.)	116.90
Average Outlet Water Temp. (F.)	140.50

CURTISS AEROPLANE & MOTOR CORPORATION

BUFFALO, N. Y.



Mr. Asquith inspecting a 'plane equipped with Lewis Gun which has just returned from a flight

"VIRTUALLY all our aeroplanes are armed with Lewis Guns and of the seven Zeppelins we have accounted for, six were brought down by the Lewis Gun."

The above statement of Mr. Sidney Brooks, English Publicist, was printed in the Philadelphia Public Ledger, February 14th, 1917.

This indicates the almost universal use of the Lewis Gun in aeroplanes in use by the Allied armies, due to the light weight of this arm, its mobility, and its versatility.

Over 40,000 Lewis Automatic Machine Guns are in use in the First Line of Offense of the Allied armies.

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WEEKLY

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Contributing Technical Editors

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VOL. V NEW YORK, APRIL 2, 1917 No. 3

4,000 AEROPLANES FOR ARMY AND NAVY BY 1919 IS PLAN OF NATIONAL ADVISORY COMMITTEE ON AERONAUTICS

ARRANGEMENTS for speeding up the plans of the Government for aerial preparedness were discussed at an all-day conference March 22, between representatives of the aircraft manufacturers of the country, the Executive Committee of the National Advisory Committee for Aeronautics and the Aero Club of America. In an address to those representing the Government and the industry attending the conference, which was held behind closed doors, Dr. Charles D. Walcott, Director of the Smithsonian Institution and Chairman of the National Advisory Committee, after reviewing the work done by the army, the navy, and the aircraft industry in the last year, said that the country had scarcely made a beginning toward real aerial preparedness.

Dr. Walcott asserted that the annual requirements of aeroplanes for the army and navy would be 2,000 aeroplanes and 2,000 military and naval aviators, and that 2,000 additional machines and 400 aviators would be needed for training pilots. The industry in its present state, he said, was unable to meet the country's requirements without great expansion.

The principal development of the meeting was the appointment of a special committee of seven to arrange details of speeding up production of aircraft and the temporary standardization of types required. This committee will consist of four members of the National Advisory Committee for Aeronautics and three representatives of the Aircraft Manufacturers' Association. Their names are withheld for the present.

"The aeronautic industry's inability to meet the needs of the Government," said Dr. Walcott in his address to the manufacturers, "is in itself only another example of the fact that though millions may be available for a specific purpose in time of great need, no amount of money will buy time. Even the most generous appropriations do not open up the years that have passed and enable us to carefully lay the foundations of a great industry and a great aerial arm through the education of engineers, manufacturers, teachers, and all of the wide variety of personnel required. An aeronautical engineer, for instance, does not step full-fledged into being, but is the result of years of patient study of and experience with aircraft. Such an evolution can only be accomplished with time.

"At the present time there are not more than twelve aeroplane manufacturing organizations in the United States with the necessary engineering and manufacturing experience and facilities to justify Government business. The first conclusion to be arrived at is, therefore, that these factories must be encouraged to expand as rapidly as possible to reach a capacity of planes per year that might be considered as our reasonable needs.

"There are many estimates of our reasonable needs, and the one herewith presented has been prepared after conferences with as many men as could be reached who have experience or judgment qualifying them to express an opinion, and after obtaining as much data as possible from Europe.

"Tentative estimate of annual requirements of aeroplanes (assumed to be possible of accomplishment in 1919):

"Attachment to an army of 1,000,000 men, 1,000 planes and 1,000 aviators.

"Attached to our fleet at sea, 200 planes and 200 aviators.

"For harbor and seaport defense, 800 planes and 800 aviators.

"Total, 2,000 planes and 2,000 aviators.

"For training pilots, (worn out or broken), 2,000 planes and 400 aviators.

"Total, 4,000 planes and 2,400 aviators."

A special committee of the Aero Club of America which went to Washington on March 21st at the invitation of the National Advisory Committee on Aeronautics, advised the Government that more than 200 wealthy men in and near New York were anxious to buy their own seaplanes and to undergo training, without compensation, if they could be taught by naval aviation instructors. This means an offer of $2,000,000 from patriotic New Yorkers, the average cost of seaplanes being $10,000 each.

Representative Murray Hulbert, Henry Woodhouse, a member of the Board of Governors, and Augustus Post, Assistant Secretary of the club, were the committeemen. They conferred with General Squier, Chief Signal Officer of the army; Dr. S. W. Stratton, Director of the Bureau of Standards; Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, and Lieut Commander John H. Towers, U. S. N.

PLANS MATURING FOR AVIATION SECTION IN THIRD NAVAL DISTRICT

PLANS for the organization of a substantial naval flying reserve force for the aerial defenses of the Third Naval District have been developed by the Advisory Committee on Aeronautics appointed to co-operate with Rear Admiral Nathaniel R. Usher, the Commandant of the Third Naval District, and are rapidly being put into effect.

The committee, which was appointed on March 2, at the request of the naval authorities, and is co-operating with the other committees working in organizing the naval reserves of the Third Naval District, includes:

Chairman, nominated by Rear Admiral Usher: Mr. Alan R. Hawley, President of the Aero Club of America, member, Aerial Coast Patrol Commission, Mayor Mitchel's Committee of 1,000; Chairman, Aeronautic Committee, National Security League.

Operations and Coordination: Rear Admiral Robert E. Peary, Chairman of the National Aerial Coast Patrol Commission, member of the Board of Governors, Aero Club of America, and other national organizations; Eugene S. Willard, Member, Committee on Naval Aeronautics, Aero Club of America; New York Yacht Club, member Board of Governors and Chairman New York State Enrollment Committee, Naval Training Association of the U. S.; Member, Executive Committee, Power Craft Association.

Enrollments: F. Trubee Davison, son of H. P. Davison, member of the firm of J. P. Morgan & Company, Organizer, Volunteer Aerial Coast Patrol Unit No. 1; Lewis S. Thompson, Training Camp for College Men.

Flying Equipment: Henry Woodhouse, Member, Board of Governors, Aero Club of America, National Aerial Coast Patrol Commission; Chairman, Committee on Aeronautics, National Institute of Efficiency; member, Mayor Mitchel's Committee of One Thousand on National Defense, National Security League, etc.; F. Trubee Davison, W. Earl Dodge, Howard S. Borden.

Torpedoplanes, Aerial Guns and Explosives: Rear Admiral Bradley A. Fiske, retired, President Naval Institute of the United States; member of Committee on Naval Aeronautics, Aero Club of America, etc.

Naval Anti-Aircraft Defenses: Eugene S. Willard, member of Aero Club of America, N. Y. Yacht Club, and chairman, New York State Enrollment Committee, Naval Training Association of the U. S., etc.; Schuyler Skaats Wheeler, President of the Crocker-Wheeler Co., inventor of numerous important electrical and mechanical devices, Vice President, Automobile Club of America, who is developing several aeronautic devices of importance; Captain Robert A. Bartlett, who was captain of Peary's ship, the "Roosevelt," in the North Pole Expedition, and of the "Karluk" on Stefansson's Expedition. (Captain Bartlett has been preparing an Arctic expedition which is to include aeroplanes in its equipment, but is now putting his efforts in developing the aerial defenses.)—Henry Woodhouse.

Communications: (Radio, signaling, etc.); John Hays Hammond, Jr., member, Board of Governors, Aero Club of America; Conference Committee on National Preparedness, Treasurer and Chairman, Institute of Radio Engineers; Lawrence B. Sperry, aviator and inventor, expert in instruments for signaling and aerial navigation, William Dubillier.

Observation Balloons: Rear Admiral William N. Little, retired, member of numerous organizations.

Instruction: Robert A. Lovett, son of Judge Robert Lovett, President of the Union Pacific R. R., member of Volunteer Aerial Coast Patrol Unit No. 1; organizer of Aerial Coast Patrol Unit No. 2; F. C. G. Eden, who is in charge of the Dodge Aviation Training Camp for college men.

Aviation Training Camps: Lewis S. Thompson, in charge of the aviation training camps of Volunteer Aerial Coast Patrol Unit No. 1; W. Earl Dodge, founder of the Dodge Aviation.

Secretary of the Committee: Henry Woodhouse.

In its second report to Rear Admiral Usher, Mr. Alan R. Hawley, the Chairman of the Committee, summarizes the work of the Committee as follows:

(1) The Committee has already received a large number of applications for training from men who would like to join the Naval Reserve Flying Corps, and has taken up with the Navy Department the matter of establishing an aeronautic station in or near New York where owners of hydroaeroplanes and flying boats can put up their seaplanes and train under the auspices of naval aviators and those who enlist in the Naval Reserve Flying Corps can take their training.

(2) A representation from the Committee went to Washington on March 21st and 22d and saw the naval authorities regarding the possibilities of establishing the naval aeronautic station in New York. The matter is being considered by the authorities. The Committee in urging that a naval aeronautic station be established in New York assured the authorities that, if necessary, the Committee will secure a suitable place for the station and will also secure all the personnel needed to run the station under the direction of the naval authorities.

(3) There are a number of owners of flying boats and people who would buy hydroaeroplanes and flying boats for their own training as well as for the use of the Naval Reserve Flying Corps, but the general feeling is that there should be a station where the machines could be put up and which would be an aviation training camp.

(4) In anticipation of getting such a station, whether established by the Navy Department or by civilians, and so as to have an experienced naval man to supervise the training of the reserves and the experiments, the Aero Club of America has paid the expenses of sending Rear Admiral William N. Little, retired, to the United States Navy Aeronautic Station at Pensacola to familiarize himself with the administration and general work of the station.

(5) Rear Admiral Bradley A. Fiske, who is chairman of the Sub-committee on Torpedoplanes, Aerial Guns and Explosives, is supervising the developing of the small torpedo to be launched from seaplanes, the Aero Club of America financing the experiments. The Committee sees prospects of obtaining revolutionary results, the torpedoes promising to be of great efficiency, notwithstanding their small size.

(6) Rear Admiral Fiske has reported to the Committee that upon consideration of the subject of preventing the landing of an invading force on our shores he finds that 100 battleplanes, equipped with three-inch guns, would afford the defensive strength of about 60,000 rifles. Shots from three-inch guns could disable and sink transports and destroyers, and the tremendous speed and mobility of the battleplanes would make it possible for 100 such machines to protect the entire coast from New York to the Chesapeake. Needless to add, the 100 battleplanes and trained personnel to operate them would be obtained in a fraction of the time required to get, train and equip 60,000 infantrymen.

(7) Within a few days every member of the Committee will get printed detailed information of exactly how different branches of the naval aernouatic service operate, and a definition of the different service which aircraft can render as auxiliaries of the Navy and naval reserve.

The Advisory Committee on Aeronautics holds periodical conferences with the Advisory Board, which coordinates the activities of the various Committees appointed to assist Rear Admiral Usher in the organization and equipment of the Naval Reserves. The Advisory Board is composed of Messrs. Arthur Curtiss James, W. Butler Duncan, Alfred R. Whitney, Jr. Aviators, balloonists, students and mechanics wishing to join the Militia should apply to Mr. Alan R. Hawley, Chairman Advisory Committee on Aeronautics, 297 Madison Avenue, New York.

PROMINENT MEN TRAINING FOR THE AERIAL COAST PATROL

Twenty-nine members of the Aerial Coast Patrol, including the original twelve members of Volunteer Aerial Coast Patrol Unit No. 1, who gained national prominence for their pioneer work in connection with the "Mosquito Fleet" manœuvres last September, have already left the Yale University and started for the aviation training camp at West Palm Beach, Florida, on Wednesday, March 28th, having received official orders from Secretary Daniels to proceed there to train.

All Yale men, these twenty-nine members of the Aerial Coast Patrol, represent some of the most prominent families in the United States. Their names are as follows: F. Trubee Davison and Harry P. Davison, Jr., sons of Henry P. Davison, member of the firm of J. P. Morgan & Co.; Robert A. Lovett, son of Judge Robert Lovett, President of the Union Pacific R. R.; Albert J. Ditman, Charles Wiman, Artemus L. Gates, Allen Ames, John V. Farwell, John Vorys, Earl Gould, Wellesly Laud-Brown, Reginald G. Coombe, Oliver B. James, G. Franklin Lawrence, William Rockefeller, Frederick Beach, Kenneth Smith, Kenneth McKleish, Curtis Read, Bartow Read, David Ingalls, A. D. Sturtevant, William Thompson, Frank Lynch, Graham Brush, Henry Landon, Samuel S. Walker, Charles Stewart, Archie McIlwaine.

This is one of the results of the patriotic work of Volunteer Unit No. 1, which was organized with the assistance of Mrs. H. P. Davison and Messrs. John Hays Hammond, Jr., Rear Admiral Robert E. Peary, Alan R. Hawley and Henry Woodhouse. Mrs. Davison, realizing the necessity of preparing her sons for an emergency, gave thorough study to the different branches of the service from the standpoint of combined efficiency and safety, and found that aviation afforded the greatest opportunity for efficiency, while at the same time being thoroughly safe.

As Earl Kitchener has said, an aviator is worth an Army Corps. General Pershing has also found that an aviator is worth a cavalry division. The work of the Aerial Coast Patrol, consisting entirely of training naval aviators, the members of the unit will form a valuable reserve for the Navy to be used in connection with the operations of the fleet and for submarine hunting and general aerial coast patrol work.

The Unit No. 1 participated in the "Mosquito Fleet" manœuvres during the week of September 5th to 12th last, under most adverse weather conditions. On September 9th one of the Curtiss seaplanes of the Unit went out to look for the two torpedo boat destroyers representing the enemy attacking fleet, and when they were about twenty-five miles outside of New York Harbor, they were caught in a thunder storm, but they located the torpedo boats, unknown to the latter and reported them to headquarters. The feat was most remarkable and convincing, and revised the opinion of naval men regarding the possibility of employing civilian aviators in naval operations. The work of the unit was so convincing

(*Continued on page 77*)

THE NEWS OF THE WEEK

First U. S. Dirigibles Ready in a Month

Washington, D. C.—Builders of the sixteen small non-rigid dirigible airships recently ordered for navy coast patrol work in co-operation with aeroplanes expect to deliver the first ship for trial flights within a month. The builders are co-operating closely in their efforts to produce the airships in the shortest possible time.

Representatives of aircraft and rubber companies were again in conference at the Navy Department with the joint army-navy board laying plans for construction of large, rigid battle craft similar to Zeppelins. The navy believes such airships would be valuable scouts.

Mr. Dodge's Aeroplane Camp

Newport, R. I.—Mr. William Earl Dodge will establish his aeroplane camp on the beach at the southern end of Newport Harbor, this Spring.

New Packard Aircraft Engine Nearly Ready

The 200 horsepower aircraft motor of the Packard Company is about ready to take flight. The process of installing the engine in specially constructed planes is now going on rapidly, and the first ascension probably will be witnessed within a fortnight.

Final work on the motor has been hastened by developments in the international situation that may create an urgent need for aircraft in America.

The flying tests of the new engine will be made at the Joy aviation field, near Mount Clemens, Mich., where there are unusual facilities for trials over both land and water.

W. B. Stout, chief engineer of the Packard aircraft division, says that the machine will not be capable of more than ninety miles an hour, because of the peculiar construction of the planes made for it, but it will be capable of mounting quickly to great heights. His observation is that the machine promises ability to ascend with at least six persons.

The tests probably will be conducted by Frank Coffin.

For Aerial Sharpshooters

Detroit, Mich.—Information was received here from Los Angeles that De Lloyd Thompson, a well-known aviator, telegraphed to eleven famous American automobile drivers inviting them to become members of an aviation unit to serve the Government in case of war. The proposed unit would be known as the Aerial sharpshooters.

The racers whom Thompson has invited are Barney Oldfield, Dario Resta, Ralph De Palma, Eddie Rickenbacher, Johnny Aitken, Howard Wilcox, Earl Cooper, Eddie Pullen, Wilbur d'Alene, Thomas Milton and Eddie O'Donnell. All of these men, it is understood, have made flights with Thompson.

Thompson plans to have the units train in Detroit, where suitable quarters are available. Rickenbacher is one of the leaders of the movement.

Princeton Aviation Corps

Princeton, N. J.—For the proposed aeroplane corps at Princeton University, more than 200 men have signed, and the committee of undergraduates is now practically assured of having machines here within a short time. The corps will be entirely independent of Government supervision and the alumni who are backing the plan will defray the expense of machines and mechanics and pilots. For the first squad of thirty men who will be selected to receive training with the machines a rigid competitive physical examination will be held shortly. A camp will be established at Princeton, where the students will be instructed daily until they can handle efficiently their machines, after which a new squad will be chosen. No selection has been made so far of an instructor, but an officer of the club declared today that a man with experience in France would most likely be chosen.

To Teach American Pilots

New York City, March 19—Lieut. Edward A. Kelly, an American aviator, who for the last year and a half has been with the British Flying Corps, arrived yesterday on the Lapland to assist in instructing American fliers at Mineola. He brought with him the plans and a model of the Vickers aeroplane, the fastest machine in existence, according to Lieut. Kelly.

Its tremendous speed, claimed to be almost 160 miles an hour, together with its easy control, make it ideal for scouting purposes, he said. The engine is made from a new alloy which is much lighter than iron or steel.

Lieut. Kelly has been wounded three times, the last time in the right leg by shrapnel while he was bringing down two German machines at the Somme. He descended inside the British lines and was taken unconscious from his machine. He is still lame and is on indefinite furlough.

Northwestern Aeroplane Co. Incorporated

Minneapolis, Minn.—The incorporation has been announced of the Northwestern Aeroplane Company with an authorized capital stock of $200,000, for the purpose of manufacturing aeroplanes and conducting a flying school.

A flying field has been contracted for, and the company will start building military scouts of thirty feet wing spread. Charles M. Peters, a former pupil of Lincoln Beachy, and an exhibition flier of five years' experience, will be general manager. The other officers are: G. Reid, president; L. E. Barrett, vice-president; Jesse Van Valkenburg, secretary and treasurer, and H. M. Westholz, superintendent of construction.

Richardson Aeroplane Co. Active

New Orleans.—Frank T. Richardson, president of the Richardson Aeroplane Corporation, Inc., with offices in the Whitney-Central building here, is in New Orleans from Washington and announces that work on the erection of the aeroplane plant in New Orleans, on the banks of the Orleans canal, near Lake Pontchartrain, will begin immediately.

Mr. Richardson made several successful tests of his new biplane at the Washington naval testings grounds.

The principal feature claimed for the machine is its inherent longitudinal stability and the tandem effect, making it impossible for the machine to take over a ten-degree angle in any direction. A demonstration flight from New Orleans and return will be made.

Mineola Notes

The twin-motored Curtiss tractor which was shown at the Aeronautic Exposition last month, is now assembled at the Aviation Station at Mineola. It is equipped with complete Sperry gyroscopic stabilizing apparatus, and a gun mounted at the nose of the machine makes it particularly adaptable for defense purposes.

The most recent addition to the field is the new Standard "J" which was shipped there last week from Daytona, Florida. Overton Bounds, accompanied by his mechanician Nick Shreyer, has returned from the south after a stay of three months, in which time the "J" was put through its high and low speed tests. The "H3" was also satisfactorily put through all the tests required of it by the War Department. Further tests will now be made at Mineola.

There are now more than twenty-five aeroplanes at Mineola, including three Standards, four L. W. F.'s, the twin-motored Curtiss, and the rest Curtiss J. N.'s.

Remy Re-Elects Directors and Officers

Detroit, Mich.—At a meeting of the stockholders of the Remy Electric Co., all directors and officers were re-elected.

Army aeroplanes landing in the snow at Mineola, Long Island, in the recent aerial maneuvres.

The latest Standard military tractor, equipped with Hall-Scott motor, at Mineola.

Curtiss School News

Miami, Fla.—The first solo flights at the Curtiss aviation school of Miami Beach were made last week by E. H. Holterman, of Woodstock, Vt., who acquitted himself creditably and won the praise of his fellow students and the instructors.

Mr. Holterman has been a close student under the able instruction of Captain Roger Jannus.

Not only has Mr. Holterman qualified in his efforts to become an aviator, but has passed the test and qualified for the United States Government and the Aero Club of America.

"Solo" flights are made without assistance of the instructor, and include landing within four feet of a designated mark; five "figure eights" between marks sixteen hundred feet apart, concluding with a landing within one hundred and fifty feet of the mark.

Another test requires the student to make five "figure eights" at an altitude of one thousand feet or over, and at this height to shut off the motor and glide down, making right and left banks at an angle of ninety degrees and landing within one hundred and fifty feet of the mark.

Favors Bill to Prohibit Hazardous Air Feats

Boston, Mass.—Godfrey L. Cabot, president of the Aero Club of New England, has requested a legislative committee to report favorably a bill to prohibit "looping the loop," vertical diving and other hazardous feats by aviators. He said there were only 100 competent aviators in the country, all of whom would be needed for Government service in case of war. The measure, he pointed out, was framed to conserve the lives of these men and those about to enter the service. There was no opposition.

Col. Lewis Sends Royalties Check to War Department

It is learned that Col. Isaac N. Lewis, U.S.A., inventor of the automatic rifle which bears his name, has sent to the Secretary of War a certified check for more than $10,000 covering the amount of royalties Colonel Lewis has received from the manufacture of his machine gun for the United States Government—and those in use by this Government even if not manufactured in the first instance for it. In his letter to Mr. Baker, Colonel Lewis said that he had absolutely not the least doubt that he was legally entitled to retain these royalties, but having maintained the position that the gun had been offered free to the United States, he preferred to conform to this attitude to the minutest detail. Colonel Lewis did not believe that the fact that he is a retired officer of the Army, entailed upon him any restraint from accepting and using such financial recompense as might come through his invention. The Secretary of War submitted the matter to the Judge Advocate General of the Army for an opinion as to whether the check could be accepted by the Department. Just what was the view of General Crowder could not be learned, but the papers, bearing his endorsement, were then sent to the Secretary of the Treasury for final action. This action of Colonel Lewis is significant in view of the statements intended to discredit his assertion that he had offered his gun to the Government free from all royalties to himself.

Army Maneuvers at Mineola

Mineola, L. I., March 22.—Twenty-five aeroplanes, piloted, some by regular army officers and some by civilians under training, composing, according to army officers at the aviation station here, the largest group of fliers that have ever taken the air together at any place in this country, went up from the Government field to make observations over a theoretical enemy somewhere in the vicinity of Mineola.

An enemy regiment—so dispatches had reported—was encamped in the vicinity. The problem was to find their trenches, such of their forces as were on the march, their motor transports, and their artillery. The fliers took the air at 3 o'clock, and within an hour and twenty-five minutes all of the information was in the hands of the officers at headquarters on the aviation field. Most of the aeroplanes had returned within forty minutes, but the squad assigned to locating the motor truck did not accomplish its mission until the truck was within three miles of the field.

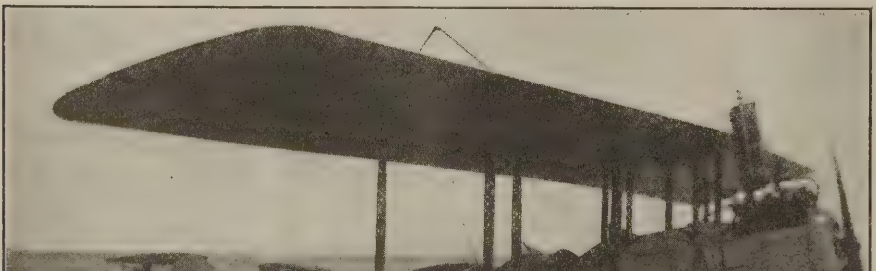
The army officers and the flying instructors were much pleased with the test, which was made without any mishaps and according to schedule. The twenty-five machines took the air in squads, to each one of which had been assigned a special mission. They ascended to heights varying from 6,000 to 8,000 feet, except the squad which had been ordered to detect the artillery fire of the enemy, which flew at about 2,000 feet.

A trench 100 feet long had been dug about three miles from the camp. Near it was an imaginary regiment represented by strips of white cloth. The motor truck which started from Far Rockaway represented a supply train, and was covered with black and white stripes. Smoke bombs were sent up to represent the artillery fire.

In each machine were an observer and a pilot. They took with them maps of the country, sketching pads, and cameras. Captain J. W. Butts of the First Signal Corps operated a camera by a revolving propeller, which permitted the taking of several hundred photographs within a short period.

The artillery fire was located first, and soon afterward a second squad returned with news of the position of the imaginary regiment. The trench also was found within a comparatively short period. The motor in the meantime had been continuing its run to Mineola, meeting on the Long Island Parkway a number of other machines, from which at a great height it was hard to distinguish it. It had arrived at Hempstead Village before the aviators discovered it.

The officers who made the flight were Captain R. C. Bolling, Lieutenant J. E. Miller, Captain J. E. Butts, Lieutenant L. T. Wheaton, Lieutenant S. H. Wehrle, Corporal W. P. Willetts, Sergeant E. R. Noyes, and Lieutenant H. H. Reynolds.



The Standard Model "J," showing the forward wheel, which prevents nosing-over in rough landings.

Aeroplane Consolidation Project Broken Off

According to a despatch in the Wall Street Journal negotiations which have been under way for several weeks for consolidation of the Wright-Martin Aircraft Corp. and the Curtiss Aeroplane & Motor Corp. "have been broken off and it is unlikely that they will be resumed."

"Tex" Millman is Buried

With military honors of the air,—the first time that such honors have been paid in America, "Tex" Millman, twenty-two years old, aviation instructor at the U. S. Aviation School at Mineola, was buried March 21st.

"Tex" was a good pilot. Although he had never won fame for any death-defying feats of the air, he was known as being as steady and intelligent a pilot as this country possesses. He was one of the youngest men in the game of young men, and was master of practically every make of aeroplane. He did not hesitate, but was always ready to take up any aeroplane, so long as it was capable of flying. Yet with all this varied experience on different types of machines "Tex" never had an accident,—**never broke a stick.** And it was not an airman's death that Peter Carl Millman died, for it was pneumonia that took him off, shortly after the great aeroplane manoeuvres at Mineola, when a fleet of 16 machines took part in a sham battle.

Immediately after the church ceremony eleven aviators went to the aviation field to prepare for the military honors, as the funeral procession made its way to the cemetery. In a little while the roar of the machines could be heard.

Into the air soared machine No. 167, driven by A. L. Allan. Then followed ten more aircraft, piloted by F. A. Bjorkland, H. H. Salmon, Lieutenant C. H. Reynolds, Sergeant L. C. Smith, Lieutenant Ivan P. Wheaton, Corporal B. L. Watkins, W. H. Blakley, W. C. Jenkins, H. H. Simons and W. L. Willetts.

Rising to an altitude of from 800 to 1,000 feet, Allan led the flyers in ever-widening circles, until a 'plane was passing every few minutes above the tiny spire on the chapel of St. Brigid's. Three times the aviators circled. And when at last they were describing a great ring the radius of which was some three miles the circles began to narrow.

While eight aviators were guiding their craft above the cemetery proper, three 'planes began a spiral descent. Suddenly the hissing sound a biplane makes when it is volplaning downward with its motor cut off was heard.

A great warbird whizzed low over the Post Road, rose suddenly again to escape the telephone wires strung on the west side of the graveyard, and skimmed onward. A second later the craft was over the grave, while from the hand of Aviator Allan there fell a bunch of carnations. The flowers landed perhaps a yard past the fresh earth.

A few moments passed, and Bjorkland sped to within fifty feet of earth. The flowers he flung landed almost in the grave, just at the feet of the pall-bearers.

As Bjorkland threw on the power and rose "June" Salmon flew low and dropped two wreaths. Then he, too, sped upward and onward to rejoin his circling comrades.

Greater and greater once more grew the flying ring. Three times more, as if in final salute, the aviators circled. Then, one by one, they passed over Garden City, and volplaned swiftly past the high board fence and the group of hangars for a landing on Mineola field.

Aeroplane Company for Montana

Great Falls, Mont.—Articles of incorporation have been filed with the Secretary of State providing for a stock company of $500,000 at Great Falls which expects to enter into the business of manufacturing aeroplanes for use in the Army, Navy and for private citizens.

It is known as the Russell Aeroplane Company and its directors are E. S. Russell, E. L. Shields, George Russell, Frank Hodous and George A. Minson, all of Great Falls.

Army and Navy News

Major William Mitchell, Signal Corps, U.S.A., who is one of the four aviation officers selected to go to France, left Washington March 17 for Havana, where he will embark for some French port. Major Mitchell will concern himself principally with the organization of the French air squadrons behind the line and the methods used in keeping them in trim for active service.

Efforts will be made as soon as the 65th Congress gets down to actual business to have included in the Army legislation some authorization for the War Department to train unenlisted volunteer aviators. This was urged in the closing days of the last session by Representative Mann, but no action was permitted. Representative Crago, of Pennsylvania, it will be recalled, proposed an amendment appropriating $1,000,000 for aviation purposes in the National Guard, but Mr. McKellar, from the same state, vigorously opposed the motion and it was killed on a point of order.

The Naval Militia aeronautical station of the 1st Battalion, N.M.N.Y., which was operated at Bay Shore, L. I., last summer will be continued this year with increased equipment. Plans have been drawn and bids requested for the erection at Bay Shore of hangars, living quarters and mess hall. The Navy Department probably will loan to the Naval Militia a large tractor seaplane for use in instructing recruits in scouting flights over the sea, and it is unofficially reported that a fund is being raised to purchase another seaplane capable of making ninety miles an hour, with a cruising radius of 400 miles. These machines, with the flying boat already on hand, will make the 1st Battalion of New York one of the best equipped volunteer aeronautic units in the country. It is expected that at least twenty well trained aviators will be turned out during the summer.

Col. William G. Haan, C.A.C., is designated as aeronautical officer of the Eastern Department. (March 16, War. D.)

Mess. Sergt. Irwin N. Zuber, C.A.C., 2d Co., Fort Du Pont, Del., is transferred as private to the Signal Corps and will be sent to Fort Omaha, Neb., for duty at the U. S. Army Balloon School. His appointment as sergeant, Signal Corps, is announced. (March 16, War D.)

First Lieut. Bee R. Osborne, Aviation Section, S. O. R. C., to active duty at Fort Sam Houston, Texas, 3d Aero Squadron, Signal Corps. (March 15, War D.)

Leave one month to 1st Lieut. David R. Wheeler, Aviation Section, S.O.R.C. (March 14, War D.)

Par. 49, S.O. 59, March 14, 1917, War D., relating to 1st Lieut. David R. Wheeler, Aviation Section, S.O.R.C., is amended so as to grant leave for ten days instead of one month. (March 16, War D.)

The following promotions, appointments and reductions in the Aviation Section of the Signal Corps, U. S. Army, are announced: To be sergeants first class: Pvts. Charley Miller, Feb. 22, 1917, and Roland G. Blake, March 5, 1917. To be sergeants: Corpls. Howard M. Logan, Samuel Salansky, Charles A. Moody, Israel Cote, Oliver Hall, Fred Mittenberg, Remorse Lovell, Roy H. Teernstra, Castor Nielsen, Frank Conger, Paul B. Begovatz, Fred P. Schoberle, Fred E. Waitt, Christian M. Sorenson and Benjamin F. Stahler, and Cook John J. Harrison to date March 16, 1917, and Pvt. Kazimierz Wajdowicz, Feb. 22, 1917. (March 16, C.S.O.)

Sergt. George I. Sullivan, S.E.R.C., Fort Monroe, Va., to active duty in the Aviation Section, S. E. R. C., with station at the Curtiss Aviation School, Newport News, Va., March 20. (March 17, War D.)

Sergt. Daniel Buckley, S.E.R.C., Fort Monroe, Va., is assigned to active duty in the Aviation Section, S.E.R.C., with station at the Curtiss Aviation School, Newport News, Va. (March 15, War D.)

Sergt. Thomas M. Ring, S.E.R.C., Fort Monroe, Va., assigned to active duty in the Aviation Section, S.E.R.C., at the Curtiss Aviation School, Newport News, Va., March 20, 1917. (March 17, War D.)

Sergt. Raymond B. Quick, S. E. R. C., Fort Slocum, N. Y., to active duty in Aviation Section at the Curtiss Aviation School, Newport News, Va., March 25. (March 21, War. D.)

Capt. Clarence C. Culver, Cav., U.S.A., who has been for several months detailed to the Signal Corps Aviation School at San Diego, Ca., was ordered to Washington during the past week for duty in the office of the Chief Signal Officer. Captain Culver has been specializing in radio work in connection with aeroplanes and is now considered an expert in that particular line. It is probable that he will soon be transferred to the experimental station at Hampton, Va., to continue the same work there. Lieut. Neil G. Finch, Field Art., who has been detailed in office of the Administration Division, Signal Corps, at Washington, has been transferred to Fort Sam Houston. He left for his new post on March 20.

First Lt. Paul L. Ferron, 6th F. A., detailed in aviation, section Signal Corps, and rated junior military aviator.

Col. William G. Haan, C. A., and Capt. Sheler W. Fitzgerald, junior military aviators, Signal Corps, detailed as members joint army and navy board for selection of sites for joint aeronautical stations on Atlantic coast.

Hydraulically Forged Steel Cylinders

The Tioga Steel & Iron Company, Philadelphia, Pa., have made a specialty for the past year of hydraulically hollow forging steel aeroplane cylinder forgings and have supplied a large quantity of these forgings to various aeroplane builders to their entire satisfaction. By their method of making these, the steel is closely confined in dies under enormous pressure, which makes the metal very dense and uniform, thus greatly increasing the physical properties and at the same time produces a superior wearing metal for cylinder construction. Thus aeroplane motor builders are not only able to save a considerable amount of machine work as compared to machining these cylinders from a solid bar or billet, but are assured of a much better cylinder and the elimination of pipes.

They are able to make these cylinders of high or low carbon, or alloy steels, such as chrome nickle, etc. They further carry at all times a large stock of steels which enables them to make very prompt shipments. They also make a specialty of forging propeller hubs, flanges and shafts, on which they are in position to make prompt shipments.

Their shop is equipped with large and small steam hammers and large and small hydraulic forging presses which enables them to cover a very wide field, and they have built up a very large business in the aeroplane and automobile field by being able to take care of rush requirements.

They have made a specialty of hydraulic pressed die forgings for many years and are leaders in this particular class of work.

The Late F. W. Roebling

Trenton, N. J.—Ferdinand W. Roebling, treasurer and general manager of the John A. Roebling Sons Company, builders of the Brooklyn Bridge and other great structures, and widely known in the wire rope industry, died March 16 at 222 West State street, this city. He had been ill for a month. Mr. Roebling was born in Saxonburg, Pa., February 27, 1842 and was a son of John A. Roebling, the pioneer wire rope manufacturer in this country. He received his education in the Polytechnic College, Philadelphia. He specialized in chemistry.

John A. Roebling began the manufacture of wire rope at Saxonburg in 1840 and he transferred his plant to Trenton in 1848. The wire rope industry was new then, for though wires for haulage purposes had been made in Germany in 1820, stranded wire rope was not made until 1834, and Mr. Roebling, Sr., was the first to manufacture it here.

S. K. F. Appoints Distributors

For the purpose of more readily supplying the requirements of the automobile trade and extending service to automobile users throughout New England, arrangements have recently been completed whereby The Post and Lester Co., of Hartford, Conn., has been appointed distributors of S K F ball bearings.

With branch houses in Boston, Bridgeport, New Haven, New London, Providence, Springfield, Waterbury and Worcester, The Post and Lester Co. will be able to supply S K F radial and thrust bearings from stock.

National Aero Institute Formed

Chicago, Ill.—There has recently been formed in this city the National Aero Institute, the purpose of which is to teach the basic theory of flight. The institute was formed by Mr. John A. Tenney, Secretary of the Advertising Association of Chicago, and the advisory board will include: Mr. Jas. J. Stephens, Vice-President of the Aero Club of Illinois; Mr. Arthur Nealy, President of the Model Aero Club of Illinois; Walter L. Brock, winner of the London-Paris race, Ellis Cook, who will be in active charge of the instruction, and the well known motor manufacturer and designer, Mr. Glenn Muffly.

Mr. Muffly will supervise the writing of the course and the organizing of the faculty. This new organization will not advertise "Learn to fly by mail" or any other unwarranted statement, but on the other hand, will submit all its advertising copy to the National Vigilance Committee of the Associated Advertising Clubs of the World. The idea will be, not to emphasize the money to be made by aviators, but the commercial future in aviation. It looks like a step in the right direction.

Will Fly to Washington

Franklin, Pa.—Congressman-elect O. D. Bleakley, of Franklin, of the twenty-eighth district, announced that when the special session of Congress begins in April he will fly either from Franklin or Philadelphia to Washington to take his seat. If a suitable landing place can be arranged at Franklin he will fly to and from the capital during his term.

The Grinnell tractor biplane, used by the Grinnell Company for instruction purposes.

AIRCRAFT MANUFACTURERS, AERO CLUB AND NATIONAL ADVISORY COMMITTEE DISCUSS SPEEDING UP AIRCRAFT PRODUCTION

The aircraft manufacturers of the United States and a committee from the Aero Club had an all-day meeting with the Executive Committee of the National Advisory Committee for Aeronautics in the office of the Advisory Committee, rooms 515-518 Munsey Building. The meeting was presided over by Dr. Charles D. Walcott, chairman of the Executive Committee. The object of the meeting was to consider ways and means to speed up the nation's aerial preparedness. A special committee composed of Mr. Henry Woodhouse, Mr. Augustus Post and Congressman Hurlburt represented the Aero Club of America.

The principal development of the meeting was the appointment of a special committee of seven to arrange details for speeding up production of aircraft and temporary standardization of types of aircraft to be required by the Army and Navy. This committee will consist of four members of the National Advisory Committee for Aeronautics and three representatives of the Aircraft Manufacturers' Association.

The prospective needs of the Army and Navy for the next two or three years were discussed. The apportionment of orders by types to the factories with the best facilities for quantity production, and the standardization of materials used in aircraft were considered. There was discussion of the steps that should be taken by the Government to mobilize the important materials that will be necessary in aircraft manufacture, and of the policy of the Army and Navy in the testing and inspecting of engines, materials, and completed aircraft.

There appeared to be strong sentiment in favor of a cross-licensing agreement of aeronautic patents. Mr. Coffin and Mr. Waldon explained the steps in the organization of the National Automobile Chamber of Commerce, and the applicability of similar measures to the aeronautic industry.

The following is a list of those present at the meeting: Dr. Charles D. Walcott, Chairman; Dr. S. W. Stratton, Secretary; Dr. Joseph S. Ames, Dr. Charles F. Marvin, Dr. Michael I. Pupin, Brig.-Gen. George O. Squier, U. S. A.; Rear Admiral D. W. Taylor, U. S. N.; Lieut. J. H. Towers, U. S. N.; Mr. Howard E Coffin, Sidney D Waldon, Henry Woodhouse, Aero Club of America; Augustus Post, Dr. W. Christmas, Christmas Aeroplane Company; Mr. G. R. Cockley, nternational Airship Corporation, Gary, Indiana; Mr. A. H. Flint, L. W. F. Engineering Company; Mr. Henry M. Frauenthal, Secretary, New York Aero Construction Company; Mr. E. F. Gallaudet, President, Gallaudet Aircraft Corporation; Mr. B. A. Guy, Curtiss Aeroplane Company, Buffalo, N. Y.; Mr. G. H. Houston, General Manager, Curtiss Aeroplane Co.; Mr. William H. Hutton, Aviation Section, War Department; Mr. C. M. Keyes, The Curtiss Aeroplane Company; Mr. Glenn L. Martin, Wright-Martin Aircraft Corporation; Mr. H. B. Mingle, President, Standard Aero Corporation; Mr. W. B. Judkins, Vice President, Standard Aero Corporation; Mr. F. L. Morse, Thomas-Morse Aircraft Corporation; Mr. Israel Ludlow, Mr. C. T. Moore, Scattle, Washington; Mr. F. H. Russell, Burgess Co.; Mr. J. W. Scott, Vice-President, Curtiss Aeroplane Co.; Mr. Henry Harrison Suples, National Venier Products Co., New York City; Mr. G. Thomas, Sturtevant Aeroplane Company; Mr. Inglis M. Uppercue, Aeromarine Plane & Motor Company; Major C. S. Wallace, U. S. A. Signal Corps, War Department; Mr. Lee S. Wallace, United Eastern Aeroplane Company; Mr. Harry D. Westcott, New York Aero Construction Co.; Benj. L. Williams, Secretary, Aircraft Manufacturers' Association; Mr. Charles F. Willard, Aeromarine Plane & Motor Company; Mr. Samuel Quinn, President, International Airship Corporation; Mr. Eugene S. Robinson, United Eastern Aeroplane Corporation; Mr. Charles B. King, Signal Corps, War Department; Mr. F. S. Dusenberg, President, Dusenberg Motor Corporation; Warren S. Eaton, New York Aero Construction Company.

The opening address of Dr. Charles D. Walcott, Chairman, was as follows:

Object of Call—To-day's joint meeting of the National Advisory Committee on Aeronautics, the Aircraft Manufacturers' Association, and representatives of the Army and Navy is called for the purpose of considering ways and means by which to speed up our Aerial Preparedness.

Congress has generously responded this year with large appropriations with which to establish air fleets for both the Army and Navy and yet a careful review of results accomplished thus far clearly indicates that, with the passing of the first year of our active aerial program, we shall appear to have hardly made a beginning.

Aeronautic Industry—The aeronautic industry's inability to meet the needs of the Government is in itself only another example of the fact that though millions may be available for a specific purpose in time of great need, no amount of money will buy time. Even the most generous appropriations do not open up the years that have passed and enable us to carefully lay the foundations of a great industry and a great aerial arm through the education of engineers, manufacturers, teachers and all of the wide variety of personnel required. An aeronautical engineer, for instance, does not step full fledged into begging, but is the result of years of patient study of and experience with aircraft. Such an evolution can only be accomplished with time.

Government Support—The aeronautic industry requires government support in its development, and this it has not received in the past in this country in a measure sufficient to enable it to meet the present enormous demands that have suddenly been made upon it. During the eight years prior to 1916, the Army ordered 59 aeroplanes and received 54. These were all supplied by four makers, and the largest number ordered from any one maker was 32 machines, not a very large amount of encouragement over a period of eight years.

During 1916, the Army ordered 366 planes and received 64. These planes were divided up among nine factories, which factories represent practically the entire producing capacity of the country. Whatever the industry may produce during 1917 is bound to fall far short of the country's needs and our meeting to-day is for the purpose of ascertaining how the situation might be helped.

Aeronautics in Europe—The tremendous urge of a life and death struggle in Europe in which command of the air is all important, has stimulated the aeronautical industry over there into a tremendous development. New models succeed new models in rapid succession in the feverish race for air supremacy and only the most perfect and up to the minute aircraft are permitted to reach the fighting lines.

The potential fighting strength of this country, if properly trained and equipped, is greater than that of any of the European countries with the possible exception of Russia. We are enormously wealthy as a nation with a tremendous coast line to protect. Whatever else in the line of preparedness we may excuse delay in we must not permit anything to stand in the way of the upbuilding of our aerial defense. It is not impossible to believe that a good navy supplemented by an adequate aerial organization, and equipment, to maintain command of the air would go a long ways in an emergency toward making up for an inadequate or imperfectly trained fighting forceon land.

We want all types of planes in large quantities, for training, reconnaissance, bomb dropping, fighting, etc., for both army and navy use. We want them as good, or better than, the best European types. We want the skilled aviators in equally large quantities to handle these various fighting machines and we want the whole program completed at the earliest date.

Present Facillties—At the present time there are not more than twelve aeroplane manufacturing organizations in the U. S., with the necessary engineering and manufacturing experience and facilities to justify government business. The first conclusion to be arrived at is, therefore, that these factories must be encouraged to expand as rapidly as possible to reach a capacity of planes pe ryear that might be considered as our reasonable needs.

Estimates of Needs of Aircraft—There are many estimates of our reasonable needs, and the one herewith presented has been prepared after conferences with as many men as could be reached who have experience or judgment qualifying them to express an opinion, and after obtaining as much data as possible from Europe.

Tentative estimate of annual requirements of aeroplanes (assumed to be possible of accomplishment in 1919):

	Planes	Aviators
Attached to an army of 1,000,000 men (that is, 1 plane per 1,000 men	1,000	1,000
Attached to our fleets at sea	300	200
For harbor and seaport defense	600	800
	2,000	2,000
For training pilots (worn out or broken)	2,000	400
	4,000	2,400

The last item of training machines is arrived at as follows: It has been found best to divide the students into assignments of five per instructor. European experience shows that it takes at least nine months to produce a properly trained advanced military aviator and that it costs approximately one and a half machines in wear and tear and breakage for each finished aviator. The breakages are most often made by the men who fail to qualify. Assuming that it would be desirable for many reasons to limit each military aviator's active duty, exclusive of war time, to one year, then we must each year produce 2,000 new aviators. Disregarding failures 400 instructors should turn out five finished advanced military aviators, each with a minimum of nine months' instruction. It is probable that the longer the time allowed and the more careful the instruction the lower would be the percentage of planes used up per aviator. Instead of 1½ per aviator we have figured only 1, or at the rate of 2,000 planes per year to produce the 2,000 finished fighting pilots.

If we assume that the above figures are approximately correct, then an industry that delivered to the Army and Navy less than 100 machines during the eight years prior to 1916, less than 100 machines during 1916, and which will deliver somewhere around 600 planes during 1917, has still to be very greatly expanded in order to reach what may be considered the reasonable requirements of the country.

Cooperation of Army and Navy—To facilitate this necessary increase of output, without the opportunity at the moment of increasing the number of different sources of supply, demands the closest cooperation between the Army and Navy and the industry in order to eliimnate very stroke of unnecessary effort and in order to concentrate all our activities upon the fewest number of types and designs of each that will completely meet our needs.

Efficiency in Manufacture—It is entirely unnecessary, for instance, to have five companies all producing a different design of training machine to do the same work. One of the five is best and when determined should be made the standard until a better is developed.

Again, with so few sources of supply, it is imperative in the interest of efficiency to not have every manufacturer producing every type, but, for instance, to allot all of the types where they can be best produced. In this way each factory will concentrate on the one or two types that it knows most about and will have volume enough to make for more economical operation and better prices. This should greatly stimulate improvement of types, for not only would a large amount of duplicate designing be avoided, but each engineering staff would be concentrating all its efforts on some particular part of the government program that had been assigned to it.

It is highly desirable at this time that there should be a very active campaign carried on in the standardization of the more common parts and fittings of planes and motors, so that when we may have arrived at such an output at 4,000 planes per year there shall be the greatest degree of interchangeability of those parts and fittings in the interest of prompt field repairs. It is also important that all of the materials themselves should have standard specifications acceptable to both Army and Navy alike.

Inspection—Must, can and should be accomplished in reconciling the many differences that exist between the inspection systems of the Army and Navy as affecting aircraft. There is room for some simplification, for the removal of some duplication of effort between the departments and between them and the manufacturers and for a standardization of practice. Considering the rapid increase in output that must be made during the next two years, it is important that this problem be intelligently handled now.

Speeding Up of Production—In order to successfully speed up production, plans will have to be laid at once and steps taken, preferably by the government, to provide in advance of actual need the different kinds of material that are had to obtain, but which must be available in large quantities. For instance, if the industry is to plan on producing 2,500 planes during 1918 and 4,000 during 1919, then there should be about 2,500,000 feet of spruce air drying right now for next year, and we should be laying down 4,000,000 feet to take care of the year after. There are about five or six items of this kind that it is decidedly to the government's interest to handle promptly in order to insure

(*Continued on next page*)

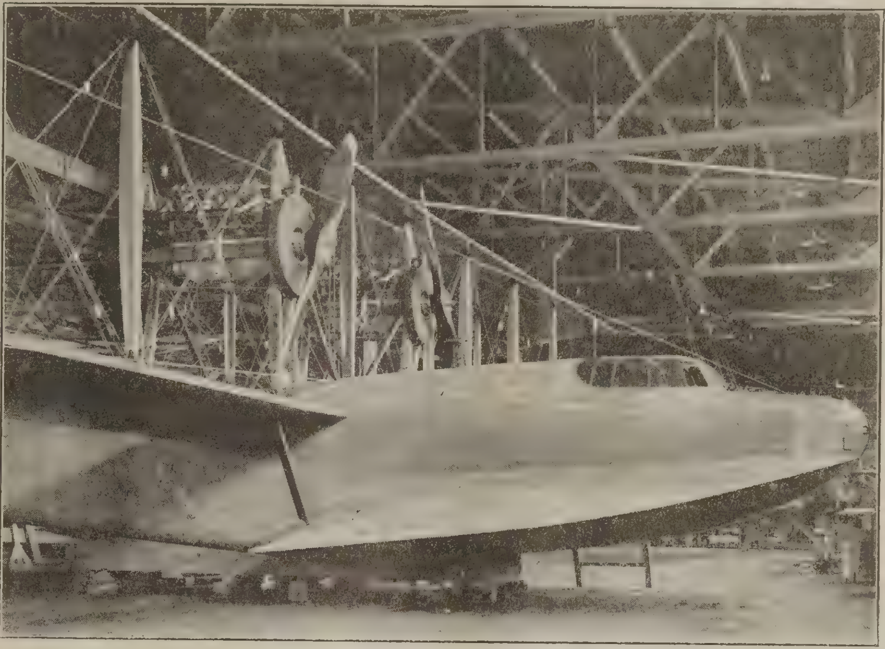
CURTISS MODEL H-12 FLYING BOAT

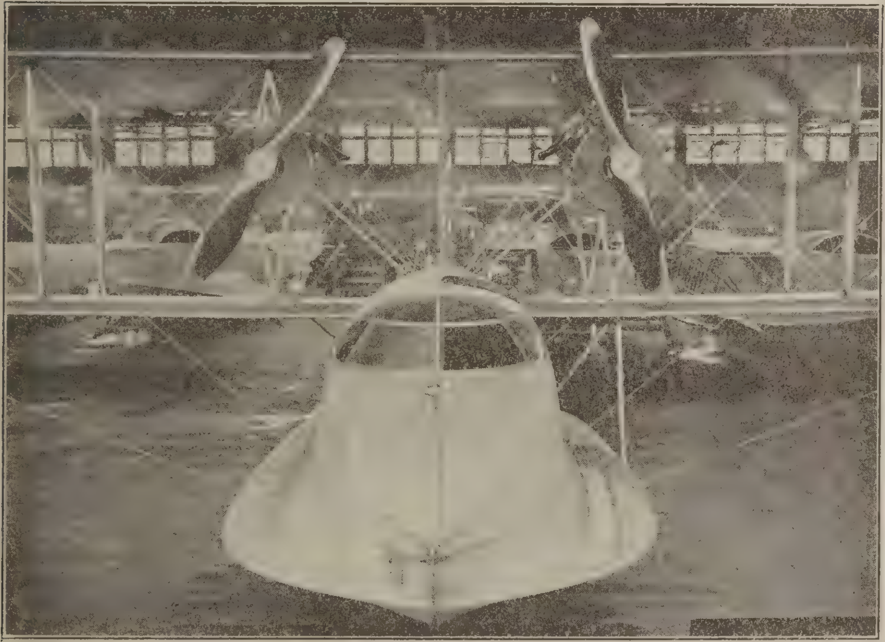
The Model H-12 flying boat, built by the Curtiss Co. for the U. S. Navy, is the largest type of flying boat in the world. First trials are to be given it at Pensacola, Fla. Although the H-12s have been turned out in large numbers for use in European navies, the demonstration flights at Pensacola will be the first to have been made by such a machine in this country.

In spite of the gigantic proportions of the boat it is easily controlled by one pilot. Four or five passengers besides the pilot can comfortably move about in the cockpit. The cockpit is entirely covered over by a hatch provided with celluloid windows permitting vision in all directions. This not only protects the occupants from the wind when in flight and spray when alighting, but also carries out the smooth effect of the hull to decrease wind resistance and skin friction.

List of general dimensions, areas and weights:

Wing span, upper plane	92 ft. 8½ in.
Wing span, lower plane	66 ft. 11½ in.
Total supporting surface	1120.78 sq. ft.
Gap between wings	8 ft. 0 in.
Height over all	16 ft. 9¼ in.
Net weight of machine, empty	5,945 lbs.
Useful load (as listed below)	2,044 lbs.
Motors (2) each 200 h.p.	400 h.p.





Useful load is figured as being composed of pilot and passenger each weighing 170 pounds; oil, 148 pounds, and gasoline, 1,556 pounds. In shorter flights the quantity of oil and fuel can be decreased and passengers carried of equal weight.

Twin motors of the Curtiss Model V2 are supported between the planes with the propellers in tractor position. Forward of the motor-carrying struts the circular radiators are located, through which the propeller shafts project. The V2 motor is an eight-cylinder V type, four-stroke cycle, rated at 200 h.p. at 1,400 r.p.m. Bore, 5 inches; stroke, 7 inches. Ignition is by two high-tension eight-cylinder magnetos and cooling by water circulated by a centrifugal pump. Two Zenith carbureters.

Gasoline consumption per b.h.p. hour, .54 pounds; oil, .03 pounds. Weight of each motor with propeller hub, but without oil or water, 690 pounds. Dead weight per rated h.p., 3.45 pounds.

The boat is expected to attain a speed of eighty-five miles an hour, and leaves the water at approximately fifty-five miles an hour.

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an adequate supply at the right time and at the right price.

Patent Situation—From the standpoint of our national defense it is imperative that patent matters be not allowed to impede this very vital industrial growth. Congress recently appropriated $1,000,000 for the purpose of acquiring by purchase, condemnation, donation or otherwise any basic patent or patents that may be necessary to the development of the industry. It is not the desire of the National Advisory Committee on aeronautics in whose hands the matters rests at the moment for recommendation to condemn or purchase any patent. It believes that such action would be construed as indicating an unreasonable attitude of mind on the part of the owners of the patents condemned or purchased, besides perhaps serving to discourage invention, if the settlement was made on too low a basis or to encourage all sorts of claims upon the industry and the government, if such settlement was on too high a basis. The Committee is therefore working diligently upon the proposition of arranging an adjustment out of courts whereby just recognition will be made to the owners of the more important or basic patents in the form of reasonable royalties to be paid by the purchasers of planes, whether for military or civil use.

Tests of Finished Aircraft and Payments—Some difficulty has been experienced at times through inability to secure tests of finished planes. The present requirements that every machine produced be tested against its specifications sometimes works a hardship on the manufacturer, who must keep his product moving and his capital turning over, when a long spell of bad weather precludes test flying. This situation will probably grow much worse instead of better as the result of a rapid expansion of the industry, and calls for careful consideration and some revision of the present arrangements in order to still arrive at the same result, but without any inconvenience or handicap to the industry. The government must of necessity surround the disbursement of the public funds with ample safeguards, but the government cannot afford to impose any unnecessary burdens upon the rapidly growing aircraft industry, and it is hoped that some helpful suggestions may be offered at this meeting looking toward improvement along this line.

Aviation—One of the really serious problems is the matter of obtaining enough competent instructor aviators to teach the very large number of young men who are applying for commissions in the Officers Reserve Corps, Aviation Section. It is apparently going to be just as serious a matter to build up an adequate force of teachers of the advanced science of military flying as now practiced abroad as it is going to be to produce the machines that are to be flown. The Army and Navy Departments are endeavoring to secure from Europe the release of the Americans serving on the western front to form the nucleus of such an advanced training organization. Both departments, however, will require the fullest cooperation of the industry and of all private schools in bringing all those who are especially gifted into this line of work.

THE GERMAN AEROPLANE ENGINE TRIALS

A Detailed Description of the Equipment and Proceedings*

When the special rocking cradle system (described in Aerial Age for March 19) came to be tested fully, it was found that it possessed certain defects, which, however, were capable of being remedied.

Clearly this type of cradle responds to all re-actionary effects, some of which may not solely result from the torque of the crankshaft. For instance, it was discovered that the direction of the exhaust blast had an appreciable effect upon the readings, and steps had to be taken to exclude any interference from this cause. As the drawing (fig. 1) shows, in most cases the exhaust was discharged straight into the air through a short length of pipe practically tangential to the crankshaft. As the exhaust gases issued they created a small reaction at a large radius, the effect of which was by no means negligible, and this was overcome either by fitting a shield to the pipe to split up the exhaust stream into two symmetrical parts parallel to the crankshaft, and thereby eliminate the reaction, or by bending the pipe so that the discharge was radial to the crankshaft.

Another point to be considered was that the rotary air draught created by the propeller acted upon the cradle and set up a torque there in the opposite direction to the engine reaction. A shield could have been fitted to eliminate the rotary component of the air draught, but it happened that there was not time to make arrangements for this, and therefore, in the actual trials, the power of the engines was ascertained by running the engine under full load at certain speeds whilst driving a propeller, then disconnecting the propeller and fitting it to the specially calibrated electric motor, and so ascertaining what power was required to drive the same propeller in practically the same position at those speeds. It might be argued that the elaborate testing plant, with rocking cradle and so forth, might have been dispensed with and the power measured directly from the electric motor used in this way. The reply to this is that these electrical motors with rocking fields are expensive, require expert operators, and are only useful over a small range of power. The rocking cradle system is therefore recommended as being quite suitable for use by manufacturers, provided attention was given to the points above mentioned, and when this rocking cradle plant is once established it can be attended to by practically any tester, and, further, it can be used for engines of almost any size and type.

It might be of interest to state that torsional effect due to the exhaust gases entering the air practically tangential to the crankshaft might be anything up to 6%, and this, of course, must necessarily be added to, or subtracted from, the total reading, according to the side of the engine to which the exhaust pipes were fitted. On measuring the torsional effect upon the cradle due to the propeller draught when unshielded, it was found that this was about 8% to 10% of the total power absorbed by the propeller.

The decision of the judges to estimate the power absorbed by the propeller by driving it and running it at the same speed by the electric motor received some criticism from the competitors because it was objected that the power required by the electric motor to drive the propeller at a certain speed was less than that developed by the engine at the same speed. It was mentioned that the engine drove the propeller at a slight fluctuation of speed (propeller flutter) which called for higher power than was the case when the propeller was driven at a uniform speed as by an electric motor. This, however, is not a virtue of the petrol engine, and the engine had nothing to its credit on this account. Furthermore, the flywheel effect of the propeller is very considerable indeed. For instance, in the case of a 100 h.p. four-cylinder engine, the corresponding propeller gives a flywheel effect which permits a speed fluctuation of only .5%.

In practice the various indicating and recording devices previously described proved to be very successful, particularly the graduated flask used for short runs. This was particularly useful during the turning up of the carbureter by the competitor under varying atmospheric conditions, which was permitted during the preliminary test. The gradual loss of weight of petrol during the run was indicated at the observer's desk by an electric lamp which was switched on each time the beam passed the horizontal. It will be remembered that this occurred each time the weight of the fuel tank was reduced by 500 grammes. The oil consumption was also ascertained by weighing, and the weight pan of these scales hung down into the observer's room.

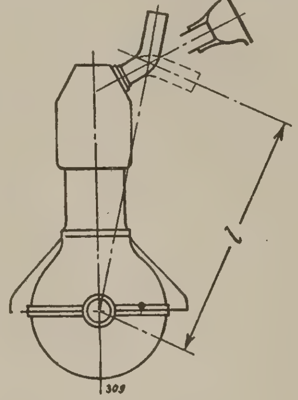

Fig. 1.

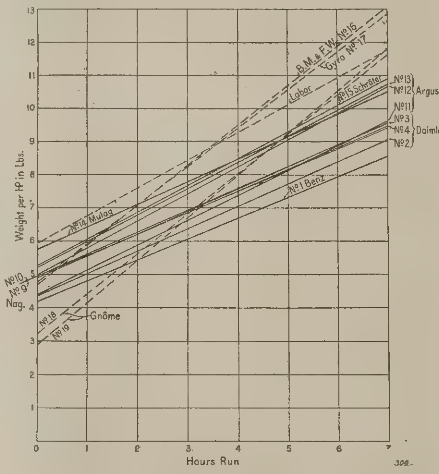

Fig. 2.

Curves showing weight per h.p. in relation to consumption.

The recording of the heat lost to the cooling water was not so easy, but great importance was attached to the accuracy of these records in order to arrive at the weight of the radiator required, as this had to be added to the weight of the engine and tanks inorder to find that of the complete power plant. One source of difficulty was the fact that the pipes were exposed to a big air draught from the propeller, and therefore all the readings were on the low side. It was one of the conditions of the trial that the weight of the radiator would be estimated at .128 lb. per 1,000 B.T.U., but this was found to be an incorrect estimate, and a better figure, which is made use of in the appended tables, is .390 lb. per 1,000 B.T.U. It is, of course, essential to stipulate some definite figure to arrive at the total weight of the plant.

The observer remained in the observer's room during the tests, entering up his records as they came along, while through a window he could see the engine being tested. In front of him was the electric bulb connected with the petrol consumption indicator. On the left was the scale pan from the oil tank and the taps for regulating the temperature of the cooling water, and the other recording and indicating devices were within easy reach. Furthermore, it was arranged that the operator actually running the engine should signal to the observer in the observer's room to inform him how the engine was running. For this purpose numerical signals were used. For instance, signal No. 1 meant that the engine was running well without vibration; No. 2, moderate vibration; No. 3, occasional misfiring, moderate vibration; No. 5, bad misfiring and bad vibration, and so forth. While, therefore, the observer was cut off from the noise of the engine, he could yet ascertain everything that was going on. The operator testing the engine had forms to fill in every hour, containing records as to petrol consumption and so on; these forms were checked with the recording instruments in the observer's room. By this means the tests were found to run off almost automatically with very small possibility of error.

The entries totalled sixty-eight, presented by twenty-six manufacturers, and list No. 1 shows the various engines entered and their performances. The tests made were as follows:

1. A preliminary test in which the engine was required to operate for fifteen minutes under full load, and for five minutes at its lowest speed. During this test the chief running conditions were recorded as well as the ease of starting.
2. Ascending test. The engine was started up in a horizontal position, and, whilst running under full load, was tilted 10° upwards, in which position it had to run for fifteen minutes under full load. The cradle was then suddenly tilted downwards, representing a sharp descent, and the engine had to run in this position first for five minutes under full load, and then for ten minutes throttled down as much as possible. Fnially, it had to be accelerated and run for five minutes under full load in the horizontal position again. In this test the acceleration of the engine was specially noted and marks allotted accordingly.
3. The main test, during which the engine had to run for seven hours without stop under full load. All that was permitted to be done was to control, from a distance of a yard and a half, the ignition and carbureter, oil, and fuel supply, and the test was broken off if the engine

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* Reprinted from the *Automobile Engineer.*

TABLE I.—STATIONARY ENGINES.

Make.	No.	Cylinders: No.	Dimensions: Bore in mm.	Dimensions: Stroke in mm.	Test Results: No. of r.p.m.	$\eta \rho$ in lb./[ ]"	Effective horse-power	Fuel and Oil Consumption: Petrol in pints per h.p. per hr.	Oil in pints per h.p. per hr.	Total in lb. per h.p. per hr.	Weight of Engine, including Radiator and Tanks, in lb.	Weight per h.p.*: Without Fuel, Oil, and Tanks, in lb./h.p.	With Fuel, Oil, and Tanks, for 7 hours, in lb./h.p.
Benz	1	4	130	180	1288	107.0	101.2	0.532	0.0365	0.513	506.0	4.20	8.58
Daimler	2	6	105	140	1387	114.2	88.9	0.575	0.0323	0.547	466.0	4.37	9.08
	3	4	120	140	1412	103.5	71.3	0.570	0.0399	0.551	407.0	4.91	9.57
	4	4	140	150	1373	102.0	99.1	0.557	0.0342	0.534	572.0	4.91	9.49
	5	4	120	140	1343	107.5	70.4	0.567	0.0266	0.534	438.0	5.36	9.96
	6	6	120	140	1315	107.0	103.0	0.595	0.0266	0.558	628.0	5.22	10.10
	7	4	110	140	1396	104.8	60.8	0.564	0.0247	0.529	381.8	5.51	10.00
	8	4	120	140	1391	98.0	66.3	0.562	0.0513	0.558	431.0	5.72	10.38
N.A.G.	9	4	135	160	1344	101.0	95.6	0.547	0.0323	0.523	549.0	4.96	9.41
	10	4	120	120	1408	95.0	55.8	0.584	0.0076	0.527	326.5	4.98	9.55
Argus	11	4	140	140	1368	106.4	96.6	0.602	0.0760	0.623	511.0	4.40	9.64
	12	4	125	130	1342	107.5	71.0	0.662	0.0703	0.670	423.0	5.00	10.65
	13	6	125	130	1370	101.1	102.0	0.660	0.0570	0.652	629.9	5.22	10.71
Mulag	14	6	110	170	1346	101.1	101.7	0.595	0.0180	0.548	679.8	5.76	10.50
Schröter	15	6	124	160	1252	79.2	88.7	0.700	0.0399	0.667	562.0	5.27	10.90

* A radiator weight of 0.625 lb. per h.p. is assumed.

revolutions dropped to 85% of the normal for more than one minute. As a matter of fact, it was generally found that when this happened a serious fault developed, and the test in any case would have had to be abandoned. It was permitted to repeat the test (but only once) if the fault were a minor one such as a choked jet or stuck oil pump valves. Sooted sparking plugs rarely caused any trouble, and naturally most of the engines were fitted with dual ignition, so that little electrical trouble was experienced.

The chief actual engine troubles were sticking valves or valve rockers due to dust stirred up by the propeller, which naturally drew protests from the manufacturers on the score that the conditions under which the tests were run were not those under which the engine normally operated. It was, however, pointed out that frequently an aeroplane engine has to go through a dust cloud, as, for instance, when the machine is starting or landing on very dry ground.

One interesting cause of breakdown of a more serious nature was that of excessive cooling of the front cylinder due to the propeller draught. This set up unequal cooling, and in some cases caused the front cylinders and pistons to crack. This trouble can, of course, be overcome by fitting a shield to the front cylinder.

4. The final test. From the seventeen engines that passed the previous tests the ten lightest were subjected to a final test that consisted of two three-hour runs. During the first two hours the conditions were made very much more difficult. For instance, during one hour unequal cooling of the cylinders was produced by delivering a blast of air to one side of the engine. For half an hour the temperature of the water entering the jacket was increased from 90° C. to 95° C. Finally, during the last half-hour the engine revolutions were increased by 100 to 150. This was effected by mounting a separate propeller on the electric motor, in front of the one on the engine, and thereby creating a draught which lightened the load on the engine. These difficult tests had no detrimental effect on the ten engines.

Unfortunately, none of the air-cooled engines were able to take part in the final tests. Air-cooled engines of the rotary type only were entered, and, as these failed in the earlier tests, nothing in the nature of a comparison between air and water-cooling was obtained. Of the five rotary engines actually delivered, one was withdrawn, three did not develop their full powers, and also suffered from minor defects that apparently easily might have been avoided. The seven-cylinder 110x120 mm. Stahlberg engine, for instance, had to be withdrawn owing to severe carbureter freezing, as the tests were made during the cold and damp days of November. It was pointed out that in normal use the carbureter would be screened somewhat, and on this account the competitor received permission to fix up a screen and enter the competition again; however, he did not wish to do this, and the engine was withdrawn.

The seven-cylinder rotary engine of the Bayerischer Motoren Flugzeugwerke G.m.b.H. succeeded in completing the seven hours' test, but at a decreased output, because one of the high-tension wires dropped off, and it was decided that this engine could not compete in the final test owing to its high fuel consumption, which raised its plant and running weight to a prohibitive figure. This, of course, is one of the defects of the rotary engine, which rarely shines well in a competition of this kind, as, although the actual weight of the engine is extremely low, when consideration is taken of the weight of the fuel and oil required, together with the tanks for carrying it, say, for a seven hours' flight, the total plant weight is considerably in excess of that of a stationary engine.

This point becomes very clear in fig. 2, in which is shown the curves plotted for the plant weight of various engines on a run up to seven hours. The abscissæ represent time and the ordinates plant weight, and in arriving at this the size and weight of the tanks necessary to hold the required amount of fuel and oil have been calculated and added. The left-hand abscissa O refers to the weight per horse-power of the various engines *without fuel or oil tanks* (*i.e.*, for 0 hour run), and it will be seen that the rotary engines show on this line a very small weight per h.p. This, however, rapidly increases with the length of the test, the curves for the rotary engines quickly intersecting those for the stationary engines. This chart shows a curve for the 70 h.p. Gnome, although it was not entered for the competition; it is included as a matter of interest, the figures having been taken from the report by M. Lumet on the French trials. It will be seen that the plant weight of the actual prize winner, including radiator but *excluding* tanks, was half as heavy again as the 70 h.p. Gnome, but that at the end of a seven hours' run the weight per h.p. of the rotaries is about 37% to 38% higher than that of the prize winning stationary engine.

The accompanying Table I. gives the technical details of the competing engines, from which it will be seen that the six-cylinder engines proved to be slightly heavier than the four-cylinder ones. Thus the weight per h.p. of the four-cylinder Benz proved smaller than that of the six-cylinder Daimler, although the latter was provided with steel cylinders and other special features tending towards lightness. The winner also has the largest stroke-bore ratio, 180x130 mm., which produced a good-shaped combustion chamber, probably accounting for the low petrol consumption, viz., .53 pint per h.p. hour, equivalent to a thermal efficiency of about 29%. The oil consumption was not very low, and the mean effective pressure of 107 lb. per square inch was not particularly high. In the best Daimler engine this pressure was 114.2 lb. per square inch.

The engine speed was not limited by the conditions of the trial except that the propeller revolutions had not to exceed 1,350 to 1,450 r.p.m., according to output. The conditions, however, favored a very high speed engine with a reducing gear, in order to discourage the use of a small high-speed propeller which is inefficient. This, however, did not attract manufacturers, and only one engine with a reducing gear, the inverted Daimler, was actually entered, but this did not come anywhere near winning a prize, owing to its big weight and the fact that the engine speed was not sufficiently high to compensate for the extra weight incorporated in the gear reduction.

The results of some of the air-cooled rotary engines are also given (Table II.), and for the purpose of comparison there has been included the 50 h.p. Gnome engine, the figures for which were taken from those obtained in the previous French trials. Of chief interest is the loss due to churning of the air, and, according to M. Lumet, this amounts to 11% of the total h.p., which coincides well with the figures obtained in these tests. This has, of course, a serious effect on the output, as the mean effective pressure of about 75 lb. per square inch could at that time scarcely be increased. The fuel consumption is also bound to be high, so that these engines are badly handicapped as soon as flights of any serious duration are considered.

(To be continued)

TABLE II.—STATIONARY ENGINES.

		Cylinders	Cylinders Dimensions			Test Results					Fuel and Oil Consumption					Weight per h.p.*	
Make	No.	No.	Bore in mm.	Stroke in mm.	No. of r.p.m.	Effect. h.p.	Churning Loss in h.p.	Total h.p.	Loss in % of Effect. h.p.	$\eta\rho$ lb./[ ]"	Petrol in pints per h.p. per hr.	Oil in pints per h.p. per hr.	Total in lb. per h.p. per hr.	Weight of Engine, in lb.	Weight of Tanks for 7 hours' run in lb.	Without Fuel, Oil, and Tanks, in lb./h.p.	With Fuel, Oil, and Tanks, for 7 hours, in lb./h.p.
B.M. and F.W.	16	7	110	120	1031	37.45	4.63	42.18	12.4	66.6	0.952	0.1235	0.990	177.0	51.80	4.72	13.02
Gyro.	17	7	109.2	120.6	954	38.75	6.02	44.76	15.5	77.0	0.884	0.1482	0.960	186.0	52.00	4.80	12.85
Gnôme I......	18	7	110	120	1194	49.00	6.02	55.01	12.3	75.0	0.887	0.1805	1.000	160.8	68.50	3.26	11.66
Gnôme II.....	19	7	130	120	1156	63.00	7.79	70.79	12.3	71.3	0.907	0.2145	1.059	183.8	93.10	2.93	11.80

(*Continued from page* 70)

that the Executive Committeee of the Aero Club of America wrote a letter of appreciation to each of the members of the Unit, reading in part as follows:

"The Executive Committee of the Aero Club of America wishes to express its admiration for the splendid accomplishments of Volunteer Aerial Coast Patrol Unit No. 1 in connection with the aerial manœuvres held at Gravesend Bay on September 5th to 12th.

"Conditions obtaining at the time when one of your seaplanes located the two torpedo boat destroyers, the Flusser and the Warrington, make us realize that such a thing could have happened under war conditions and this achievement would have saved New York from being bombarded by the enemy's fleet.

"Owing to the fact that the United States Navy has only a few aeroplanes and trained aviators, in case of war the naval aviators available would barely be sufficient to operate at one of the naval centers or in connection with one of the squadrons of the fleet. We can conceive of the Flusser and Warrington representing a raiding squadron having succeeded in getting near New York, screened by the fog, and being found by one of the seaplanes of the Volunteer Aerial Coast Patrol Unit No. 1, thereby saving the ships at the entrance of New York Harbor from being destroyed and New York City from being bombarded. Your valuable work in locating mines also deserves commendation."

Following the manœuvres, the Unit went to New London, and carried out continuous experiments in cooperation with the naval authorities at the Naval Station. Upon their return to the University for their studies, the members of the Unit found Yale enthusiastic over their achievements, and they received hundreds of applications for admission in the Aerial Coast Patrol.

The twenty-nine men will train at West Palm Beach for six weeks, after which they will return to New York and train here. They will be joined by sixty others.

F. Trubee Davison and Robert A. Lovett are Chairmen of the Sub-committees on Enrollments and Training, and part of the Central Advisory Committee on Aeronautics, which is cooperating with Rear Admiral Nathaniel R. Usher in the organization of the Naval Reserve Flying Corps for the Third Naval District. Mr. Robert J. Ditman left for the U. S. Naval Aeronautic Station at Pensacola, Fla., two weeks ago to familiarize himself with the work they are doing there.

Mr. Lewis S. Thompson, a prominent New Yorker, a friend of the Davisons, has gone to West Palm Beach with the Unit to supervise the administration of the Unit.

The training, the cost of which will be paid for by Mr. H. P. Davison, will take place at the training camp at West Palm Beach, established by the American Trans-Oceanic Company, the organization established by Mr. Rodman Wanamaker to develop the plans for the Transatlantic flight. Mr. William D. Gash is President, Mr. Stewart McDonald is the manager, and David H. McCulloch is the chief instructor.

The Aero Club of America officials and officials of the Aerial Coast Patrol Commission, of which Admiral Robert E. Peary is chairman, commended the unit for their promptness in taking steps to prepare themselves to meet the national emergency.

THE TRAINING IN MILITARY AVIATION

(Lecture by General W. S. BRANCKER, R. A., Director of British Air Organization, before the Aeronautical Society of Great Britain)

(*Concluded from page* 19)

AEROPLANES AND ENGINES.

The next point which affects requirements of training is the provision of aeroplanes and engines. Here again controversy is eternally raging as to the best types to employ. Before the War, the general idea was that a beginner should be taught on the box kite, and this idea has lasted inasmuch that today nearly all our pupils start their instruction on a Maurice Farman. Personally, I have been opposed to this system, but I may be wrong and have given way to the majority, and I think from the instructor's point of view the Maurice Farman is a very nice, safe machine on which to get the pupil through his first experience of dual control in the air, althought in the actual movements necessary for controlling the machine it is different to almost any other machine in the Service. The 80 Gnome Avro has, beyond the Maurice Farman, been our stand-by in advanced training and is a thoroughly good machine for this purpose, light in handling, comparatively sensitive, and not too difficult to fly. For some time, pupils were successfully started on 80 Avros, but when Maurice Farmans are available in sufficient quantities the concensus of opinion has been that it was better to stick to that machine for preliminary training. Now, however, we have a new type, the first of which has just flown, which I hope will eventually eliminate the box kite type of training machine altogether. Another point on which much argument arises is the use of stable machines for training. When stable machines first came in, all the old conservative pilots shook their heads sadly and said that you could never make a good pilot on a stable machine; that idea has died, but there are still many instructors who insist that to make a good pilot he must first be trained on an unstable machine before being allowed to go on a stable one, to make him careful; but, after all, *landing* is the great thing, and stable machines are just as hard to land as unstable. Personally, I am not at all sure that this is correct, and I believe that a pilot trained on stable machines from the start, after he has had about 30 hours' air experience, will be so confident and have such a good idea of what a machine ought to do in the air, that he will fly an unstable machine without even realizing its instability—that is to say, of course, if he has been properly taught. So far as engines go, it is only natural, through the demands of war, that we have been forced to use our obsolete engines for training purposes. As a matter of fact, these obsolete engines are just what are not required for training purposes, because being of an early type they are more liable to failure than the modern types, and engine failure is just what one wants to avoid in training. The output of the trade, however, has precluded the manufacture in numbers of a special training engine. But now that the obsolescent engines are of newer types, this difficulty will tend to disappear.

TECHNICAL AND MILITARY TRAINING.

Now to turn to the actual process of training. I will consider it under two heads—technical training both on the ground and in the air, and military training both on the ground and in the air. The first portion of technical training is the care of engines, rigging of aeroplanes, the use of the compass, the use of instruments and other such details. This is carried out at the two schools of military aeronautics; engines are taken down and erected and are run, samples of as many types as possible being provided to give the pupil wide experience. The same applies regarding the rigging and erection of aeroplanes, and pupils are made thoroughly conversant with the use of all the instruments. Thus a pupil before he actually learns to fly really has some knowledge of his engine, his machine and its instruments. He then goes on to preliminary and advanced training squadrons and continues to learn the enormous amount there is to learn on these heads by practical experience both in the air and in the squadron shops.

A very debatable point in the actual training in flying is whether reserve squadrons should train pupils all through—*i.e.*, from the very start up to the time they get their wings, or whether, as is the system at present, they do preliminary training with one reserve squadron and go on to higher training in another. There are certain arguments for and against both systems, but we have adopted the second. The greatest argument in favor of the first system is that the one instructor can take a pupil and really get to know him and follow him right through his training, but practically preliminary training takes a shorter time than advanced training, and the system of military training is simplified by separating preliminary flying training from the advanced flying training. One great advantage of placing preliminary training and advanced training in separate squadrons is that the squadrons can be homogeneous in equipment. So much for the technical training; it is fairly simple given a sound instructor and good weather.

I have already explained the many military qualifications demanded from the modern pilot, and the military training on the ground, like the technical, is carried out at the schools of military aeronautics where the pupil gets a good grounding in the use and care of the machine gun, wireless, artillery observation, photography and bomb dropping, and this training he completes from practical experience when he gets on flying instruction.

During his preliminary training in flying instruction, his military training is still theoretical and on the ground, but in the advanced training squadrons he begins to fly in formations and to drop bombs or their equivalent at a target. He carries out practical artillery observation by means of powder puffs on the ground which represent the bursting of shells, and he is sent out across the country to photograph various points in the neighborhood, and until he has proved himself efficient in all these operations he cannot be a qualified pilot. Fighting in the air is also practiced by various methods; two machines may be sent up to manœuvre against one another, both trying to attack, or the pupil is sent up whilst the instructor tries to attack him, or *vice versa,* or the instructor goes out and attacks a group of his pupils returning from a cross-country flight and so on.

FLYING AS A RECREATION.

I think I have made it fairly clear that training in aviation from the military point of view is getting more and more complicated, but I hope that I have also made it clear that actual flying from the practical point of view of getting from one place to another has become very easy and comparatively safe, and that, therefore in Peace everyone who can should take it up as a means of travel and a means of recreation. The great factor against aviation for such purposes is our uncertain climate, but with experience and with reliable engines it is possible to fly in almost any weather short of a thick fog, a hurricane or a violent thunderstorm. All these can be avoided by skill in navigation and a certain amount of weather wisdom.

I am always racking my brains for possible improvements in our system of training, and perhaps tonight I shall get some ideas. The only improvements I can think of at the moment are better qualified instructors and more of them, more reliable engines, and slower and more deliberate training, possibly including handling of the controls in an apparatus on the ground which will respond in much the same way as an aeroplane would in the air, but all these improvements are impossible to any extent during the stress of War, because the supply is forever trying to catch up the demand, and the demand is forever increasing both in numbers and quality. Sir Douglas Haig needs a certain fixed number of squadrons, and we must produce them or try to. In Peace we cut our coat according to our cloth.

THE BEST PILOTS.

The next point of interest to me is the actual study of the men who make the best pilots. The most unexpected people make good pilots, and very often the most promising ones never attain more than mediocrity in the air, and for this reason it has always seemed to me undesirable to lay down a stereotyped process of training. Personally I think that any sound man with sound nerves (and women, too, for that matter) can make a good, useful pilot, but it is only the exceptional individual who will make the really brilliant fighting pilot. Even the unsound; we have deaf people and people with wooden legs, etc.

There is always a great controversy as to the best age for flying, and as to the extreme age at which anybody can learn to fly. I think that there is no doubt that the best age to learn to fly is as young as possible, just as a boy learns to ride, but during War this is impossible, as the pupils would be too young to fight. We take a few below the age of 18 now, but, generally speaking, 18 is rather young for the great strain of active service, and I prefer the man of 20 to 25. When you come to the older category, I think everything depends on the life which the individual has led. A man of between 35 and 40 who has lived a hard life and is a good horseman will probably turn into a good pilot quicker than the man of from 25 to 30 who has spent his life in an office or doing nothing, but as a rule the older man will not stand the strain of active service fighting as long as the young man. The quality of horsemanship is quite a useful one in any would-be pilot. The requirements are just the same—good hands, a good head, steady nerves and judgment. Flying is perhaps a little easier than riding because you sit in a comfortable armchair in a quiet machine instead of on a slippery saddle on a very lively horse. Generally speaking, I think it is only youth that makes it possible to become a really star pilot who can do almost anything in the air without loss of nerve. Probably the young man of 18 to 25 makes the best fighting pilot, whereas the older man will do best on long reconnaissance and artillery work, where less dash and more experience and endurance are required.

Very much depends on the character and temperament of each man, and the ideal in training would be to teach almost every pupil somewhat differently, just as every young horse wants somewhat different handling to get the best results. The bold require holding back and the timid require pushing on. The fast learners want careful watching and the slow learners need infinite patience; so far as my experience goes almost an equal number of good pilots are produced from each of these categories.

A point of interest in this connection is the relative status of pilot and passenger, flying officer and observer. The Germans and ourselves are quite different. The Germans have a certain number of officer pilots, but a good many N.C.O.'s. Their observers are all officers and are supposed to take charge when in the air. As a rule, I think their observers very seldom become trained pilots.

In the Royal Flying Corps almost all pilots are officers—and the N.C.O.'s very soon get commissions if they do well—and the observers, although officers as a rule, are absolutely under the control of the pilot. Our observers, after a certain period of successful work in that capacity, are allowed to learn to fly, and usually make very good pilots. Two completely opposite theories, of which I think ours has proved to be the best. I think there are certainly cases where German N.C.O. pilots have shown cowardice and the officer observer has been unable to control them. Anyway, we go on with our system, and it works well, its only drawback being that we lose our observers just as they are getting really experienced—but experience is often equivalent to tiredness and caution.

QUESTION OF ACCIDENTS.

Another point of interest is the danger connected with training in flying. During Peace the first consideration was to avoid accidents, which roused foolish questions in the House, and in consequence delayed progress and wasted everyone's time. Since the War started, we have got away from that sort of nonsense, with the result that we take far greater risks than we used. In spite of this, the percentage of accidents has not really risen appreciably very much. A good many deaths are reported in the paper and frighten a certain number of people, but when you compare the number of deaths with the very large numbers of pupils in training and the very large number of hours in the air accomplished every day, the price is not great, and in the present stage of aviation the fact must be fearlessly accepted that no progress can be made without a certain cost in human life. When we return to Peace conditions, the ruling consideration will be the safety of the pupil, as practically all the other factors which govern us now will have vanished. We shall then be able to keep a man under training for a far longer period and take him much more slowly in the early stages, give him more instruction on the ground by means of various mechanical devices, and in fact render him almost immune from the ordinary accident. There is one very satisfactory feature in looking back through the accidents which have occurred since the beginning of the War in training—there have been extraordinarily few cases of breakage in the air, which speaks very well for British construction and inspection. The most common type of accident is engine failure, followed by an effort to turn sharply into a possible landing place and losing speed on the turn, which results in a dose-dive and serious smash. Even good and experienced pilots are prone to do this, and to me the only cure appears to be the avoidance of engine failure. This will assuredly come in Peace, when we can devote more energy towards real reliability in the engine instead of extreme lightness and exaggerated performances.

There are several points I want to hear your views on, for instance:—

Methods of training;
Size of aerodromes;
The value of the Maurice Farman;
Stable and unstable machines;
The division of preliminary from advanced training in flying;
Age and youth.

FINEST MATERIAL IN THE WORLD.

As an officer who has been responsible for training in the War Office now for four years, I feel that I have been wonderfully lucky in having the finest material in the world to work on both for instructors and pupils. The Englishman may be conservative, but he is certainly the finest pilot in the world; the value of all the old British characteristics which made us masters of the *Sea* is intensified in the *Air,* and they will make us masters of the air yet, in spite of our politics and our system of government, and all the many obstructions to progress which will assuredly spring up as soon as Peace is declared. War has been the making of British aviation, and we must look to it that we preserve and develop the fruits of this War so far as aviation is concerned. Now by technical training in the air I mean instruction in flying pure and simple, without any direct reference to its military uses. The best method of teaching flying is probably the most controversial point I shall touch on this evening; opinions differ enormously, and I am not going into a long dissertation on the subject, as I hope that some of you here will give us the benefit of your views at the end of the lecture.

During Peace a good many pilots learned to fly by the light of nature. They were just put into a machine and made to taxi about on the ground until they knew the controls, and then pushed off into the air, and left to take their chance—a thrilling moment both for themselves and their instructors. Now, I think it is fairly well established that dual control is an absolute necessity. It gets the pupil into proper habits in the early stages of his training, and this he cannot really dispense with unless he is a heaven-born genius who takes to the air as a duck does to water, and there are certainly some men who seem to require no training at all.

The most difficult part of flying is landing. Once off the ground and above any neighboring obstacles, flying is easy unless the engine gives out, or you meet very bad weather. The whole difficulty is to land safely. The most critical moment of a pupil's education is his first solo flight. I know one of my teachers always said that no one ever saw anything at all during his first two hours alone in the air. This was not quite true, but the feeling that you are up alone for the first time and have *got* to come down again is most alarming, and I've known cases where pupils have simply looked straight to their front and flown for many miles in a dead straight line until their petrol was finished and they had to land!

The stereotyped method of starting instruction is on a Maurice Farman, with a dual control, up and down "straight," gradually giving the pupil more and more control until he lands properly. In fact, nearly the whole art of flying lies in landing, and a man who lands well under any conditions will certainly be able to do anything else in the air well on his own initiative given a sound nerve. After the first few solos on an easy type of machine, the pupil usually returns to dual control on a faster and more efficient machine—after many and wearisome circuits and landing with dual control he is sent off on his first cross-country flight, another really thrilling experience. Before being allowed to do this, however, a pupil should be able to land within a marked chalk circle and his engine stopped from any height, and to have practiced landing slowly over obstacles.

Training by Instruments.

During this period of training one of the great bones of contention used to be the advisability of training a pupil to fly by means of his instruments as opposed to balance. Instruments used to be unrealiable. Instruments of late have become more and more reliable, and personally I am the greatest believer in using them for training. After a little experience with instruments as a guide, any intelligent man will find himself working without them instinctively, and they will have tided him over many dangers in the early stages. I have already talked about stability, and I think the day will come when an unstable machine will be looked upon as impossible. Another very interesting point is the value of air experience as a passenger before learning to fly. I did a good deal of flying as a passenger before I learned to fly, and I must say my own impression was that this air experience was invaluable. I am sure I learned far quicker in consequence of knowing exactly what was going to happen and exactly what cross-country flying was like. Our chairman, however, always says I am one of the worst pilots he has ever seen, so he will not agree.

I used always to be of opinion that a large amount of passenger flying would almost teach a man to fly before he was asked to touch the controls at all, but I have been somewhat disappointed in actual results. We get a good number of observers home from France for instruction in flying, and many of these have 150 to 200 hours' air experience. They certainly do learn quicker than the man without air experience as a rule, but the difference between them and their less experienced comrades is much less marked than I had expected. Why, I am still at a loss to understand, but certainly experience seems to prove that four or five hours' experience as a passenger is advisable and will probably hasten a pupil's progress in the early stages, but that any time beyond this is really not of much value.

Well, once the ice is broken by the first few cross-country flights, progress becomes rapid, and the pupil soon begins to really *handle* his machine in the air, and to practice real aerial gymnastics, such as steep spirals, loops, tail-slides, and so on. Then slowly the air habit begins to grow on the man, if he is ever going to be any good, and experience—and nothing else—makes it possible to land almost anywhere in a bad country with the engine stopped dead, and to drop faultlessly on to a strange landing place without any indication of the direction of the wind on the slope of the ground, and to manœuvre round and over storms, and find your way regardless of weather. As the pupil goes on, the best form of training is to force him to fly in really bad weather. There is nothing which gives so much confidence as a successful bout with a nasty day. Weather has extraordinarily little real effect on flying so long as it is sufficiently clear to see; fog and very heavy rain are the two really undefeatable factors in aviation. The War has taught us to laugh at weather. It is only four years ago that "bumps" were looked upon with the deepest reverence and respect, and there were certain crossings over the rivers and hills around Salisbury Plain which were usually avoided except by the boldest. Today, however, no one ever thinks of them, and yet almost the same machines are being used for preliminary training as were being used then. It is a very good example of the wonderful growth of confidence in the last few years, which has done much to push on the progress of aviation.

On the whole, flying itself is so easy that pupils suffer from over-confidence.—Careful teaching is essential, and very careful instructions as to the best method of meeting any emergency, such as a spin or a nose-dive, and it is only quite lately that we have had any authoritative statements as to how to compete with these situations, and even now there are probably people who differ as to the best course to follow if you find yourself nose-diving out of a cloud.

Anyway, the actual assimilation of the art of flying—or the Air-habit—is largely a matter of Air experience, and, given nerves and health and common-sense, there are very few Englishmen who won't make good pilots so long as they have sufficient experience.

The Discussion.

M. Jullerot said that he did not consider that dual control machines and box kites, etc., should be used for long in the instruction of the pupils, as they were quite different to the machines used for flying purposes, and it was impossible on them to get the proper range. With reference to instruments, he was dead against them in the beginning. The pupil looked at the instruments the whole time, and they were very often wrong, and in his opinion they should not be used until the pupil could fly properly without them; if they were used, it was better not to look at them. After seven years of flying he had now started using instruments, and he often found them wrong. They could not be used in very fast machines, and for the preliminary training he would rather not have any. Dual control is a necessity at the present time, as we have not time now to risk the other method. Dual control, with the seats arranged side by side, would be the ideal type of teaching machine. The British monoplane had given very good results. As regards the age for starting, he advised men should be unmarried, if possible unengaged—(laughter)—and of good heart. He stated that short-sightedness was not a bad thing, as it prevented people seeing too much. (Laughter and applause.)

Major Smith Barry said he would like to endorse what M. Jullerot had said about dual control. He would like to see it carried out more fully, and the pupil not being allowed to leave the ground until he had sat in the driver's seat. He thought there would be an economy of machines brought about by this, as only one type of machine would be required, and he thought six hours on one type with this method of teaching would be sufficient. He also thought that there should be a school of instructors and specialists who did nothing else, paid rather more or less than other people, and that they should be judged by the number of smashes and be held responsible for them. There should be none of these, except those due to engine failure. All should carry out the same views and teach in the same manner, and there would be more esprit de corps than exists at present. Teaching is now largely carried out by men home from France resting and waiting to go out again, and there was not the interest attached to the work that there should be, and this spirit was infused in those they taught. Where possible, where there is a two-seater and a scout of the same design, it would be a very good thing if the pupils could be trained on the two-seater before the scout.

Mr. A. V. Roe said he was in favor of the dual control machine, and he was of opinion that it was better for the flyer to be in front and the pupil behind; he then could watch the movements of the instructor with great ease.

Mr. Gordon England agreed with M. Jullerot that the side-by-side machine had very great possibilities. He had used one some years ago and he had found it almost possible to speak to the pupil while in the air, and with some types of people who forgot everything they had been told to do on the ground, this was of enormous advantage. He would like to be able to cut out and restore the control at will, but that at present all forms of control were complicated and unreliable. He thought it was bad for pupils to have instruments, and that it was better to learn to fly on sense alone, and not to bother about speed indicators.

Wing Commander Longmore said he did not believe in dual control. He had found it possible on the pusher type of machine to talk to the pupil, and if necessary to bash him on the head if he made a mistake. (Laughter.) He thought the pusher machine would give better results than the tractor, even though the pusher were bigger and harder to house and keep in trim. The pupils trained on a pusher could then go to a dual tractor, and then go by themselves and spend much time in the air in a moderately powerful tractor before going on to a scout school where they only use and fly scouts. He stated that seaplane instruction is very much the same as in an ordinary aeroplane. As regards instruments, he agreed with M. Jullerot and Mr. Gordon England. With reference to crowded aerodromes, he agreed with General Brancker, only he would put the number under instruction at 100; there were many narrow escapes on a misty or cloudy day flying at 2,000 or 1,500 feet.

General Brancker, in reply, said that instruments evidently seemed to be a very controversial point, but he still stuck to his own opinion on the point. Instruments needed to be looked after as much as engines. The idea of the two-seater side by side seemed well worth trying, but it must be remembered that at present they only had obsolescent flying machines used for teaching purposes. He thought Major Smith Barry was approaching the ideal in his remarks, which could not be done during the war.

Mr. White Smith moved a vote of thanks to General Brancker for his lecture, and Colonel O'Gorham to Commodore Paine for presiding. These were seconded and carried, and a very interesting and successful evening terminated.

THE CASE FOR THE LARGE AEROPLANE

By F. HANDLEY PAGE, A.F.Ae.S.*

THE question of aeroplane size is a most important one. It raises the whole question as to whether there is, or is not, a limitation to aeroplane size, and therefore whether progress in construction will be limited to improvement on present-day small types of machines, or whether there is an infinite possibility in the extension of designs to much larger types.

It has been argued by many that, just as ships, trains and other machines for transport purposes increase in size as years go on, so will the aeroplane progress, and that the larger aeroplane will have a definite place in the field of aviation. Others have adopted the opposite view.

The general consideration in favor of the large machine is that although there is a heavier initial capital outlay, large machines are much cheaper to build, cheaper to maintain and cheaper to run than small ones, and thus progress is seen in every type of mechanical transport towards the employment of larger and larger machines with a view to taking full advantage of the economies effected.

In an aeroplane there could, however, be no advantage in the use of large machines if that increase in size gives a disproportionate increase in weight which would more than nullify constructional advantages, or if the large aeroplane had aero-dynamical disadvantages. The whole case needs most careful examination from all points of view.

In the arguments set forth both below I have endeavored to compare machines of different size and review their relative advantages, determining first of all bases of comparison to enable a true picture to be obtained. As these necessitate the explanation of a new method of aero-dynamical composition I have set this forth at rather greater length than is necessary for the development of the argument proper. After a discussion of the aero-dynamical problem I have dealt with the effect on structural weight of an increase in the size of aeroplane, and then turned back to find the effect on the aeroplane's performance of the weight variation with size increase. Lastly, there are a few notes on the large machine from a flying standpoint. It is a matter of some difficulty to obtain a true basis of comparison from pilots' opinions. Pilots are, as General Brancker remarked in his paper, a very conservative body, opposed to innovation, and the machine of the moment's design is not necessarily the one of the future, or the one from which future machines will be developed.

Aerodynamical Bases of Comparison

To determine the calculated performance of any machine it is necessary to have available the wind-channel experiments on the Lift and Lift/Drag of a large number of planes as well as the resistance for various types of bodies similar to that proposed to be used. The curves of Lift and Lift/Drag are usually plotted in absolute units and in the form shown in Fig. 1.

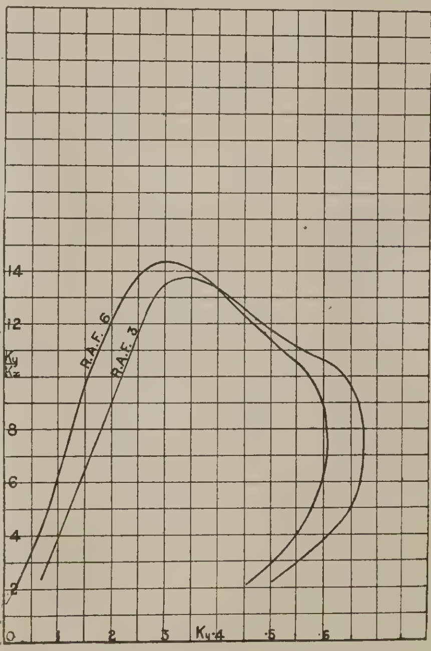

FIG. 1

From these wind-channel curves the performance of the whole machine is obtained.

After the general details of a machine's design are settled, such as the weight to be carried, the area of the planes, etc., the plane resistance at various speeds are found from the Lift and Lift-Drag curves. To these values are added the correct ones for body resistance, the values of the two curves added together and the total horsepower required calculated for different speeds. When the engine power and propeller efficiency is known, the curve of available horsepower can be plotted and the points of intersection of the two horsepower curves mark the limits of aeroplane speed variation.

It is quite easy to see that this method, although exceedingly useful for any particular aeroplane, does not afford a quick means of comparison between a machine with planes of different section or different shape or loading. I have therefore adopted a different method of plotting, so that the performance of any machine can be directly predicted from the wind-channel tests, on the Lift and Lift/Drag of the planes used, and on the body resistance, the new method taking into account the effect of altered loading or varying air densities at various heights.

I will deal first of all with the plane calculation.

The following is the notation adopted:

V —velocity of the aeroplane in ft./sec.
W —total weight in lbs. of the aeroplane.
A —area of main planes in sq. ft.
—density of the air in lbs./cu. ft.
g —32.2.
Ky—absolute value of the Lift Coefficient.
Kx—absolute value of the Drift Coefficient.
Rb—total body resistance in absolute units per ft. per sec. of the aeroplane considered —*i. e.*, resistance of the chassis, body, struts, in fact all the resistance of the aeroplane except that of the planes.

The following equations may be written:

$$W = Ky \cdot \frac{e}{g} \cdot A \cdot V^2 \quad \ldots \quad (1)$$

whence

$$V = \frac{1}{\sqrt{Ky}} \cdot \sqrt{\frac{W}{A} \cdot \frac{g}{e}} \quad \ldots\ldots \quad (2)$$

or

$$V = a \cdot \frac{1}{\sqrt{Ky}} \quad \ldots \quad (3)$$

The twin-motored Atlantic Aircraft Battleplane, with two Aeromarine motors.

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* Lecture delivered before the Aeronautical Society on February 7, 1917.

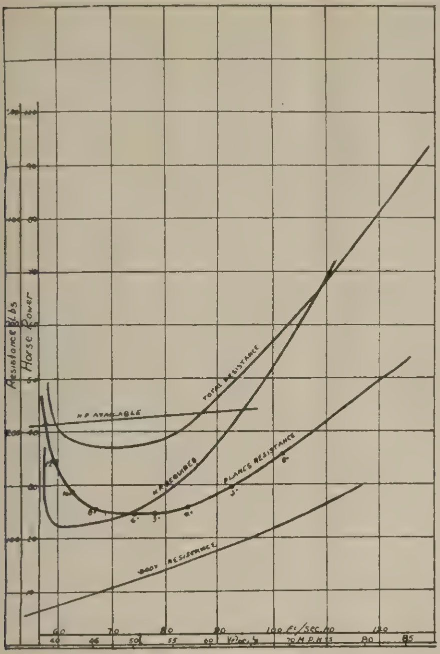


FIG 2

where

$$a = \sqrt{\frac{W}{A} \cdot \frac{g}{e}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

$$\text{Resistance} = Kx \cdot \frac{e}{g} \cdot A \cdot V^2 \quad . \quad . \quad . \quad . \quad (5)$$

$$\text{H.P.} = Kx \cdot \frac{e}{g} \cdot \frac{A}{550} \cdot V^3 \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

Inserting the value of V from equation (2) above

$$\text{H.P.} = Kx \cdot \frac{e}{g} \cdot \frac{A}{550} \left(\frac{W}{A} \cdot \frac{g}{e}\right)^{\frac{3}{2}} \quad . \quad . \quad (7)$$

Whence

$$\text{H.P.} = \frac{Kx}{Ky}\sqrt{\frac{1}{Ky}} \cdot \frac{W}{550}\sqrt{\frac{W}{A} \cdot \frac{g}{c}} \quad . \quad . \quad . \quad (8)$$

or

$$\text{H.P.} = b \cdot \frac{Kx}{Ky}\sqrt{\frac{1}{Ky}} \quad . \quad . \quad . \quad . \quad . \quad (9)$$

Where

$$b = \frac{W}{550}\sqrt{\frac{W}{A} \cdot \frac{g}{e}} \quad . \quad . \quad . \quad . \quad . \quad (10)$$

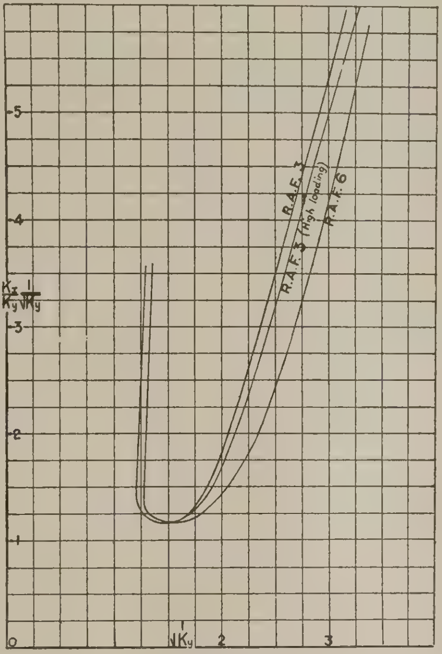
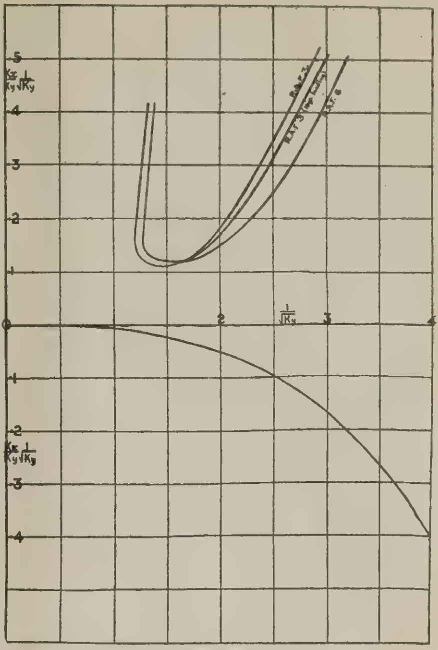


FIG. 3



Summarising

FIG. 4

$$V = a\sqrt{\frac{1}{Ky}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

$$\text{H.P.} = b\,\frac{Kx}{Ky}\sqrt{\frac{1}{Ky}} \quad . \quad . \quad . \quad . \quad . \quad (9)$$

Instead of the usual Kx and Ky curves for a plane there will now be plotted

$$\sqrt{\frac{1}{Ky}} \text{ and } \frac{Kx}{Ky}\sqrt{\frac{1}{Ky}}$$

which is equivalent to plotting h.p. required against velocities. A curve for the section known

(*Continued on page 86*)

The twin-motored Handley-Page biplane, which carried twenty passengers in a test flight made recently at Hendon. The power plants are Rolls-Royce motors.

FOREIGN NEWS

FRANCE

Paris, March 23.—A report current for the last three days that Sergt. J. R. McConnell, an American aviator with the French army is missing, has been confirmed. When last seen he was in battle with two big German aeroplanes.

McConnell and Edmund Genet, another American, went out on Monday over the lines of the retreating Germany army, McConnell flying lower than Genet. They met two two-seated German machines and the two Americans attacked them. Genet was slightly wounded in the face, and as the blood ran into his eyes he was forced to turn about.

Nothing has been heard of McConnell since. It is hoped he has landed and been taken prisoner. French machines sent out to see if the remains of his plane were visible reported that they could not see them. It is hoped that German aviators will drop the news of McConnell's fate on the French lines, as the airmen of each side usually do.

In a letter the correspondent of *The Sun* received yesterday from McConnell, written on Saturday, the American aviator told of a narrow escape on the previous day. Five American aviators of the Lafayette escadrille, of whom McConnell was one, flew twenty-four miles within the German lines, observing the villages burning in the area the enemy was evacuating.

The Americans were flying low, under 5,000 feet, and the German machine guns opened fire, using luminous bullets. As McConnell said, "I could see them passing my plane like a jet of water sparkling in the sunlight." McConnell got into a sharp fight with two German machines in which they managed to signal his range to their anti-aircraft batteries and duck away to escape the shrapnel. Shrapnel burst all around McConnell, who escaped untouched.

Two Americans, Hoskier and Genet, almost were in at the death of the German Zeppelin that was brought down at Compeigne. They were misdirected and steered north instead of south. The Americans got lost, as they reached a part of the country not covered by their maps, and landed thirty miles away. As they were four hours overdue, the escadrille feared they were lost until they returned.

Sergt. J. R. McConnell is a son of Judge S. P. McConnell, of Carthage, N. C., president of the Randolph and Cumberland Railroad. He is a graduate of the University of Virginia and at the time of his departure for France in the fall of 1914 was industrial agent for the railroad.

The March issue of *National Service,* the official monthly publication of the Training Camps Association of the United States, the organization of the Plattsburg men, publishes an article by the late Sergeant James R. McConnell. The article captioned, "The Day's Work of an American Airman on the Somme," probably was the last written by the daring flier.

"Yesterday," he writes, "was Christmas. The weather was too bad to fly in, but one pilot tried it and killed himself landing.

"As we and our guests sat down to our Diner de Noël (Christmas dinner), I noticed we were thirteen at table. I commented on it to Lieutenant de Laage, whom I was sitting next to. I explained that with thirteen at table it was supposed that one of the assembly would die within the year. He laughed. "'Well, it will hold good with this crowd,' he said, 'but unfortunately there will probably be more than one.'"

In another part of his article Sergeant McConnell said:

"As I write, a newly fledged birdman arrives at our escadrille, in the person of one Hoskier, from South Orange, N. J. He came to France seven months ago for the purpose of enlisting in aviation, and since then has raised the batting average of the Americans in the flying schools. The lieutenant calls me aside and asks me to explain to our newest addition the military deportment expected of him. It is the first time he has been at the front and, to be on the safe side, he punctuates his replies with 'Sir.'

"During the winter months the weather does not permit of much flying, but aviation has greatly developed in the last year and machines now fly under conditions which, twelve months ago, would have been considered a bar to aerial activity. As early as the summer of 1916 artillery regulating aeroplanes did work in the rain, traveling at times no higher than 400 feet. Avions de chasse were never called upon to go out in such weather. Also they never flew at night—it was thought impossible to land them. The fall of 1916 saw these swift, silver-colored fighting craft darting over the lines even when a canopy of mist would force them to stay under 500 feet, and taking the air on nights when moonlight brought only dimly into relief their landing ground. However, operations of this sort are very limited, for they serve little purpose."

GREAT BRITAIN

Private cablegrams received by John F. MacKay, publisher of *The Toronto Globe,* tell of a thrilling engagement in the air over the lines in Flanders, in which his son, Captain MacKay participated.

Captain MacKay is the youngest captain in the British Army and was with the British Aviation Squad "somewhere in Flanders." While flying over the German lines 5,000 feet up he was attacked from above by seven German aeroplanes, which opened fire on him. His observer was killed, Captain MacKay wounded, and part of the machine was shot away. To save himself, Captain MacKay reversed his aeroplane and made a vertical dive to earth of more than 3,000 feet.

He managed to right the machine just over the British lines and land safely. A bullet, which passed through his helmet, raised a lump on his head, but did not penetrate the skull.

He is now in a military hospital and cables to his father, saying he is well on the road to recovery.

Paris.—Vernon Castle, according to a correspondent of the *N. Y. Globe,* dancing man and air fighter, is in from the front for a few hours in Paris after a heroic experience in which cool courage saved his life for further service as a member of the British flying corps. As a part of his day's work he was ordered with three others, mounting single-seater fighting biplanes, upon a particularly dangerous mission over the enemy's lines.

Castle's machine was the target of a direct hit by an aircraft gun. The propeller and part of the rotating motor were shot away while the machine was at a low altitude, but he succeeded in landing unwounded just behind the British second line.

Clouds usually prevent reconnaissances from the air, because it is folly to fly at the low altitude necessary to move beneath them, which is the only way to see the ground. Consequently there is little air activity on cloudy days when the ceiling of the sky is 1,500 feet or less from the earth. Yet Mr. Castle and his brother airmen under these hazardous circumstances set out to obtain information of exceeding importance in connection with the British advance in the Ancre region.

While beneath the clouds at an altitude of 1,000 feet Castle became the target of a German "archie," or anti-aircraft gun. When he had recovered from the shock of the explosion, caused by a hit, he was almost directly over the German first line in a shower of bullets from rifles and machine guns. However, he glided to a safe landing on the shell-holed mud recently captured by the British. While the batteries were occupied with Castle, the two other airmen fulfilled the mission assigned to the party.

Recently another British airman met a fast German fighting machine above the clouds at a moment when, on account of a failing motor, he was about to return. Unable to maneuver on account of lack of power, the flier seemed an easy prey, but several German rapid fire volleys failed to hit a vital spot on the machine or its pilot. On account of the reduced power the British flier found it impossible to get the German in range of his gun. Realizing that it was only a question of time when he himself would be fatally hit, he determined to ram.

The next time the German approached firing from below the British machine was suddenly thrown into a steep dive with the machine gun rattling. Before the expected collision occurred the German pilot fell back in his seat. The Englishman avoided the crash by a few inches and both machines went to the ground back of the British lines, the German craft in flames. The victor, looking for his enemy's identification disk, saw seven wounds in the German's chest.

HOLLAND

A German aeroplane which flew over Sluis recently was shot at and hit by Dutch troops who were maneuvering in the neighborhood, according to the *Handelsblad.*

The aviator was wounded and compelled to descend in Dutch territory, but before he could be overtaken by the Dutch soldiers, he restarted his machine and flew three hundred meters over the border into Belgium.

German troops hurried to his rescue and he was carried away by Red Cross attendants.

Sluis is situated on the Belgium-Holland border, ten miles northeast of Bruges.

JAPAN

The following are from the *Kobe Chronicle* just received:

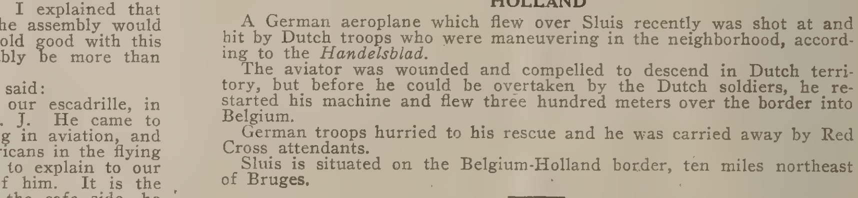
Thursday, February 15.—One of the military aviators who arrived at Kofu from Tokorozawa on Monday (12th instant) started on his flight over the high mountains of Koshu and Shinshu provinces to Lake Suwa. The aviator, however, encountered strong adverse winds between Yakegatake and Komagatake and finding further progress impossible, had to return to Kofu. The flight for the day was abandoned.

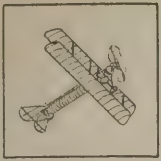
The flight over the mountains had to be abandoned again yesterday owing to unfavorable weather.

Friday, February 16.—After forced idleness for two days at Kofu owing to unfavorable weather conditions, Lieutenants Makabe and Takikawa left Kofu on the 15th instant at 7:30 A. M. and, successfully negotiating the high mountains standing between Kofu and their destination, safely arrived at Suwa. After encircling the frozen lake several times the aviators alighted on the ice, where a large number of people had assembled to welcome the arrival of the aviators.

February 14.—A new aviation college has been established by Mr. Tamai Seitaro at Haneda, near Kawasaki, midway between Tokyo and Yokohama. Mr. Tamai has secured a large field containing 300,000 *tsubo* from Viscount Ijuin, and has built a school and dormitory buildings. Ten students have enrolled in the school and the formal opening of the college will be held April 1. The term of the school is three months and the tuition for the term is 200 yen.—From *Japan* ***Advertiser.***

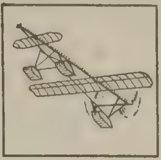
Nippon Flying School, and the students' training aeroplane at the Haneda Aerodrome.





MODEL NEWS

Edited by G. A. Cavanagh



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Scale Models

In these times with compressed air and gasoline motors available for use in model aeroplanes, model flyers are showing greater inclination to the construction of scale models of large machines through the use of which, it has been proven, greater results can be obtained from a scientific and educational standpoint. At the aeronautic exposition scale models of Curtiss, L. W. F. Nieuport and various other types of successful machines were on exhibition, but the most promising of all for actual results was the model monoplane equipped with a one-half horsepower gasoline engine constructed by Mr. Young, of Mineola, Long Island, N. Y. Mr. Young stated that on several occasions good flights were made, but with a few modifications and changes he contends that even better results are possible.

Achievements along these lines are not entirely due to the ing of all for actual results was the model monoplane equipped reports that have appeared in Aerial Age western model flyers have shown a tendency toward the construction of scale models to be driven by compressed air or gasoline engines instead of rubber strands.

Perhaps the foremost of western model flyers interested in the development of the mechanical driven scale model are Mr. Henry Rompel, Kansas City, Mo.; Mr. William Kohler, Los Angeles, Cal., and C. Otis Dumm, Boulder, Colo., whose photograph was reproduced in our issue of October 9th, 1916. Mr. Dumm is responsible for the construction of at least two dozen scale models of prominent aeroplanes. In our issue of December 25th descriptions and photographs were reproduced showing the rotary gas engine and scale model constructed by Mr. Henry Rompel, and in a forthcoming issue a photograph and description of Mr. William Kohler's gas engine-driven monoplane will appear.

From a standpoint of recreation and a minor knowledge of aeronautics the rubber strand A type model has proven itself to be a suitable medium. But on the other hand, if a more comprehensive knowledge of the principles of aeronautics is desired, there is but little doubt but that the engine driven scale model affords the most satisfactory means to realize this desire. Although the number of those now engaged in the development of efficient scale models is small, there is ample reason to believe that the time is not far distant when the majority of model flyers will devote their entire attention to the more efficient method of acquainting themselves with the fundamental principles of the aeroplane. The results of those whose activities have already been announced is evidence of this fact.

A Scale Model of a Nieuport Monoplane

The model of the Nieuport monoplane herewith described was constructed by Mr. Otis Dumm, Boulder, Colo., and is perhaps the most perfect of all the models in his collection. The model was constructed as near to scale as is possible and represents a splendid example of good workmanship. Although the model is not capable of flying, there is little doubt but that it could be adjusted as to enable the installation of a compressed air motor.

The wing spread from tip to tip is 52½ inches, the length of the model being 39⅛ inches overall. It is fitted with standard Nieuport system of control, wing warping by foot, with a single lever for rudder and elevators. The ribs are each different in shape and are built up of 1-16 by 3-16-inch spruce. The main spars are ⅝-inch thick by ¼-inch wide at the center and taper to both body and tip, thus producing a true Nieuport curve and chamber for each rib. A four strand cable is used for the bracing of the wings, two strand cables being used for the control wires, all of which are tightened with turnbuckles. The cowles are made of aluminum as is also the front.

Oval brass tubing ⅛ by ⅜-inch is employed in the construction of the undercarriage with a real stout laminated leaf spring and two 2½-inch rubber tired wire wheels. The model contains a seat for observer as well as pilot imitation leather being used for upholstery. The edge of the cockpit is likewise upholstered with imitation leather. Spruce ¼ by 3-16-inch is used throughout the body of the machine. The controls are made to operate similar to those of a large machine.

A 12-inch laminated propeller is used in connection with the model, the propeller having been made up of ten sections of wood in the following proportions: four mahogany, two white oak, two birch and two maple.

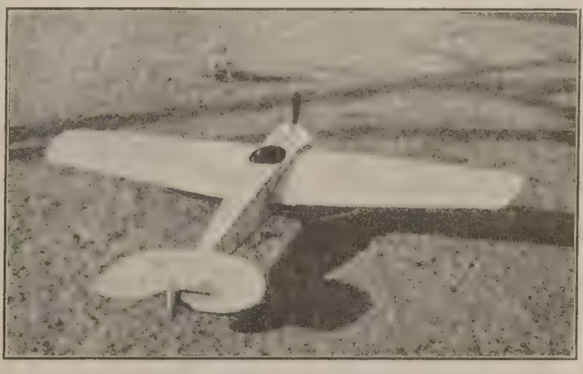
Perhaps one of the most interesting features of the model is the imitation engine. The miniature engine is of the Gnome type and is mounted in the cowl of the machine. The entire engine is made from hard wood even to the valve stems, rockers and radiating pins to which the cylinders are joined. An electric motor is situated behind the engine and is used to revolve the engine and propeller to produce a real effect. The chassis is enameled black, the entire covering of the machine being coated with varnish and shellac.

Following the Nieuport fashion the turnbuckles are fastened to heavy tin clamps to the wing spars. The warping wires are confined in brass tubes of 1-16-inch outside diameter.

The machine complete weighs but 3½ pounds and was built to a scale of 1½ inches = 1 foot.

The small machine shown in the photograph was made after the design of the large machine and is scaled ¾-inch = 1 foot. The body and wings of the small machine are made of cardboard covered with cheesecloth wood of ⅛-inch dimensions being used for the landing chassis and spars.

In addition to being president Mr. Dumm is perhaps one of the most active members of the Boulder Model Aeroplane Club which promises to be a very active club.



Large and small Nieuport models made by Mr. O. Dumm.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Calling on a Motor Manufacturer

On Octember 87th, 1919, we took the train to Powerhorse, N. Y., to interview the designer of that great motor, the Rabid Radial Rotary. We had been warned that he was an exceedingly hard man to interview, very modest for one of such genius. However, we have never failed in an interview yet, so we decided to take a chance. To make a long story a little longer and to fill up space we will proceed. We arrived at Powerhorse, and immediately went to the Rabid Rotary Factory. One could see it from a great distance, and hear the throbbing hum of the workmen chewing gum, mingled with the sound of the rest drinking soup at their noon lunch hour. We approached the factory, opened the door, entered, and were promptly thrown out by the watchman. However, upon explaining our purpose he apologized and let us in. We gave our card to a man standing there and directed him to take it to Mr. I. M. Boranstroke, the inventor of the engine. He hurried away, and came back in a half hour. (The factory was so large that it took two men a half hour to walk its length. Question for mathematical readers. How long would it take three men, and why?)

We were ushered into Mr. Boranstroke's presence, and took a chair. (And a cigar from the humidor by the table). We decided that we would open the conversation, and wishing to make a particularly apt remark we said, "Well, sir, nice weather we're having."

The famous man looked out of the window and said, "My motor is the most wonderful that has ever been devised. In fact it beats a lot of motors that have only been imagined."

Ah, now I had him started!

"Mr. Boranstorke," I parried, "Would you mind telling me something about your motor and what your plans are for its marketing?"

The great man paused, mopped his brow, and breathed heavily. We could see that he was undergoing some very tremendous emotion, and that his reply would be of great importance to the motor world in general. Finally he opened his mouth.

"Yes," he gasped.

"Ah, you will tell me," I returned.

"You asked me would I *mind* telling you," he said, "and the answer is *'yes.'* Luke!"

And they threw me out in the cold, cold night.

But the report was handed in to the boss follows:

"When interviewed by our rising young reporter, Mr. I. M. Boranstroke gave out the following specification of his motor.

Pistons. Twelve.
Cylinders. Ditto.
Bore. 48 calibre.
Stroke. 35 a minute.
Revolutions. See Russian History.
Weight. Quite light.
Price. Never sold one.

(*Note. The writer of the above article has been discharged.* —Aeronitis Editor).

Puerile Poems

Dmirsky was a pilot
In the Army of the Czar,
But falling from his aeroplane
His features he did mzar.
(*Hint—The Z is silent.*)

After deep thought, we have hit upon a way of punishing the "Little group of willful men." Put the whole crew of them in a Zeppelin and send them on a raid over London.

Under the title "A Contribution to Science and Literature," *Aeronautics* (London) prints the following:

"Full many are the controversies that have raged anent the precise method whereby we destroy Zeppelins. The censorship unhappily forbids us to reveal in the detail the means utilized for this purpose; but in Japan, if we are to believe the *Daily Express,* they are more fortunate in this respect; for a peripatetic Japanese officer contributes to our contemporary the following accurate description of the means whereby we secure the country's defense against aerial attack.

"Two more Zeppelins to fall in Essex County. That extreme best news make all Kyoto most glad. 'Very soon' friend remark upon me, 'German Zeppelin will know it is the certain deaths to make air raid on England. Then air excursions are to stop.'

"England's air defense is nearly perfect to the present. When Zeppelin come to England only one thing is to do. Turn on all searchlight on Zeppelins. Then make gun fire upon them until Zeppelin full with holes. This is what happen then. English aeroplanes make chase upon German airships, but latter is full with gun holes, therefore most impossibility for Zeppelin to rise in clouds. What happen? Honorable Great Britain aeroplane makes descent upon Zeppelin, then latter fall in flame and crew becomes deadish. This is Japan idea how to make destructions on air raiders.

"We have to thank the writer of this illuminating revelation not only for his contribution to the history of aerial service by his convincing explanation of the manner in which a Zeppelin can best be brought down, but also for enriching the English language with the picturesque and descriptive word 'Deadish' which, we hope, will live."

If we may be permitted to interject a word here, we may say that we slightly suspect the editor of *Aeronautics* of having read our Hashimura Togo.

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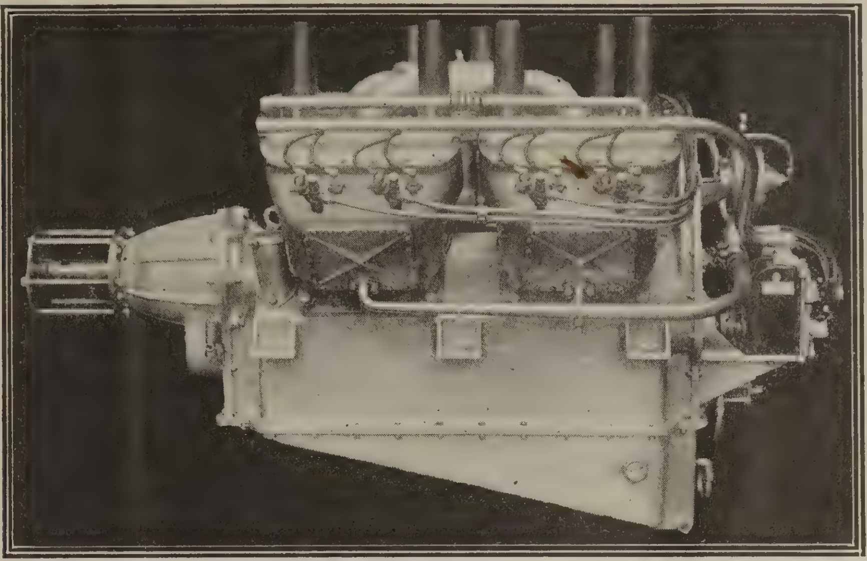

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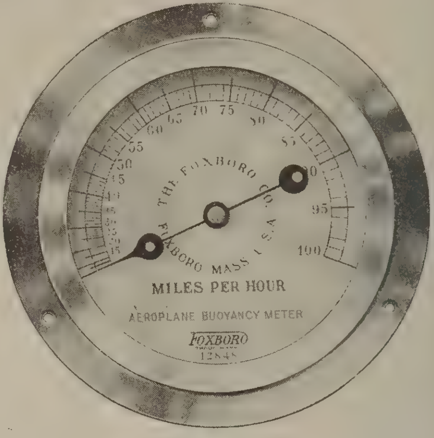

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(*Continued from page* 81)

as R.A.F.6 and one for the section known as R.A.F.3 have been plotted out in this way. It is well to examine these curves to see their general application before proceeding to deal with the question of plane comparison. In Fig. 4 are plotted the ordinary Kx and Ky curves for R.A.F.6 and R.A.F.3. R.A.F.6 has the lower value of Ky maximum and higher value for Ky/Kx. The maximum value of Ky for R.A.F.6 is ·605, and that of R.A.F.3 is ·695. The result of this is reflected in the curves in Fig. 3 where R.A.F.3 gives a slower landing speed than R.A.F.6 for the same loading. The slow speeds are related in the ratio of the sq. root of their maximum Ky or in the ratio of 1 to 105. These plotted curves give them the relationship between h.p. and velocity for equal loading. If it is desired to know the actual speeds obtained with different h.p. or in effect to obtain the correct scale for these curves it is only necessary to obtain the multiplying factor, converting the horizontal scale into feet per second and the vertical scale into h.p. This is done by evaluating the constants a and b in equations 4 and 10 above, inserting therein the correct valuation of W, A and e/g.

(*To be continued*)

What the Army Lacks

(Editorial in the Chester, Pa., Times)

To day we lack, in round figures, about 2,000 aeroplanes, 25 dirigibles and 150 observation balloons to make this country seventh in aeronautic equipment for aeronautic defense. We have only about 100 trained military aviators, and plans to train about 400 more. Yet the aviation section of the American Signal Corps has received about 1,400 applications from candidates. There is no dearth of men competent to fly and willing to learn; only the machines and equipment are missing, and that is now being supplied as rapidly as possible.

Germany at present has over 9,000 aviators and about 20,000 machines in daily use in the war zone, and she is building machines to carry fifteen tons, equipped with high speed motors of 300 horsepower. England has 107 aviation and kite balloon training schools and is rapidly drawing near her plans to have 10,000 aeroplanes in service. In the Royal Flying Corps there are all told 100,000 men, including officers, aviators, gunners, mechanics, repair men and others connected with the business of flying.

According to Alan R. Hawley, Henry Woodhouse, and military men qualified to know whereof they speak, the United States needs at once 2,000 trained pilots with a ratio of three machines to each pilot, which proportion has been found most practical in Europe. Of course this is to obviate delays caused by breakages and overhandling.

At present we have not a single dirigible in operation in the United States service. America is not, however, without patriotism among her aviators and ship builders, and several patriotic concerns have expressed their willingness to undertake the work at cost. Among these concerns are ship builders, used to hurry orders, and with nearly all the necessary factors at their command.

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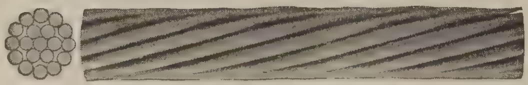

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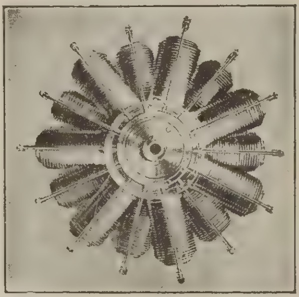

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MODEL AEROPLANES AND THEIR Motors, by George A. Cavanagh.

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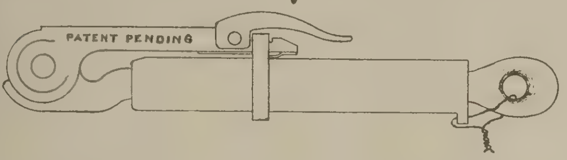
A Labor and Time Saving Invention

The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

From the description above given, the advantages of the *Bellanca Turnbuckle* over all other types will readily be seen and appreciated.

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EVERY SHAFT GUARANTEED

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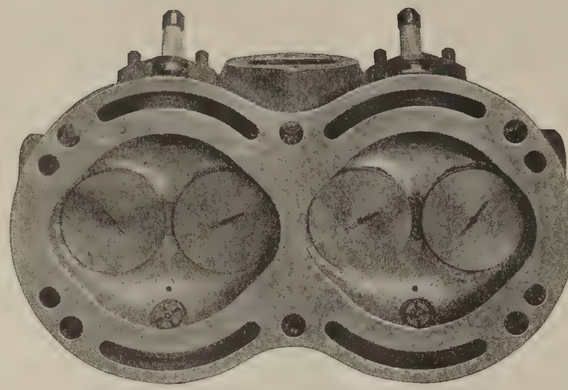

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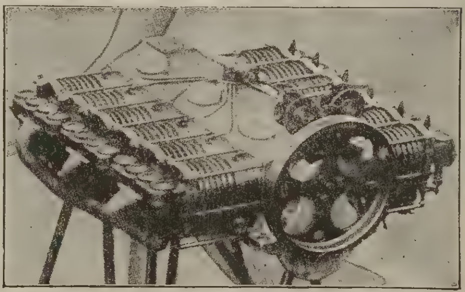

3/4 top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

ASHMUSEN HIGH GRADE POWER PLANTS

ARE NOW READY FOR THE MARKET
Patents allowed and pending.

They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
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Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11½ Gals. per hour, Low Grade.
Oil Consumption—70 H.P.—¾ Gal. per hour, Good Grade.
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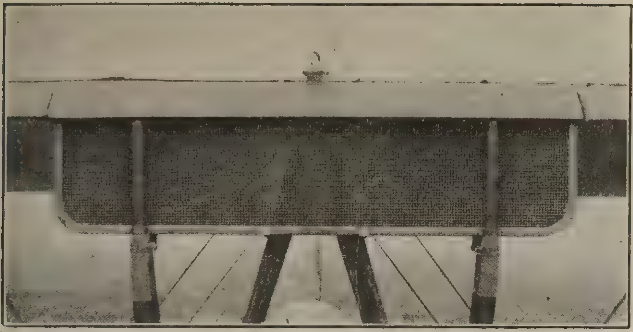

TYPICAL of the practical correctness of many innovations introduced by Sturtevant aeroplanes, is the small light radiator which fits neatly into the top wing. The circulation system is greatly improved, and the weight and resistance reduced by this simple and efficient solution of a difficult problem.

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Supplied to U. S. Navy, U. S. Signal Corps, leading manufacturers and to different Foreign Governments.

In material, workmanship, pride of manufacturers, no effort is lost, no expense spared to make this Barometer worthy of the Tycos Reputation.

Let us submit information on this Barometer as well as on Inclinometers and Pocket Altitude Barometer—the purchasing we leave to your discerning judgment.

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The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

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Now offering special inducements to students enrolling in winter classes.

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You will find the Hess-Bright Manufacturing Company to be such an organization. You will find the Hess-Bright Ball Bearings to be of the quality which can only result in the product of such an organization.

Hess-Bright's Conrad Patents are thoroughly adjudicated

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Curtiss J. N.
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Equipped With
Ackerman Wheels

"IT'S IN THE SPOKES"

AFTER four years' exhaustive tests, The Ackerman Wheel Company offers to aeroplane builders a wheel of special design that will solve many of the difficulties hitherto encountered.

In a series of laboratory tests (see illustrations below) the wheel was attached to a large case, into which was loaded 1,500 pounds of sand. A side thrust blow, with the wheel seven feet removed from the point of contact, was calculated to give the wheel a stress of 27,000 pounds. This was when the wheel struck the plain floor surface. To test the wheel to its maximum, two cleats of wood were nailed to the floor, four inches in advance of the striking point, and under this test four spokes of the wheel were broken. Calculation showed that the energy of the blow totalled 49,800 pounds.

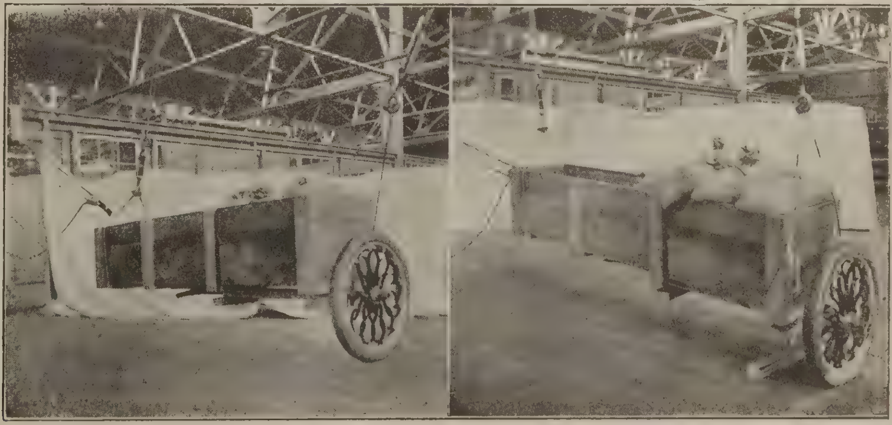
A special alloy, specially treated, is used to meet all conditions that the wheel can be subjected to. The steel receives a special process in the treating, so that it will give the required resiliency, starting at the center of the curve and gradually growing stiffer and stronger both to the hub and relative to the structure of the spoke. The spokes being made on the curve, they are hung on the hinge at the rim, being a unit in the hub, allowing them to open and shut according to the load placed on the hub.

In the aeroplane wheel it is found that the hub will leave the center four inches when maximum loaded, and return to center as load is decreased, without the springs taking a set. There has never before been a wheel invented which would meet any such conditions.

These wheels can be built according to size and weight of any load from 500 pounds up to 5 tons

Write for complete information to

THE ACKERMAN WHEEL COMPANY
Rockefeller Building, Cleveland, Ohio



AVIATION TRAINING

THE CURTISS School of Aviation will give training this winter, in Florida, to those civilians who may be accepted by the Aviation Section, U. S. A., upon their having made application for enlistment in the Aviation Reserve Corps. Applicants must be between twenty-one and twenty-seven years of age, possess good health, character and college education or equivalent. Tuition will be paid by the Government.

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AERIAL AGE
WEEKLY

Vol. 5, No. 4 APRIL 9, 1917 10 CENTS A COPY

One of the aviators at the U. S. Army Aviation Field, at Mineola, making a picturesque landing in the moonlight.

With the Allied forces in the Balkans.
A Lewis Machine Gun in action against
a hostile aeroplane

U. S. Senator BRADY: "Have we developed a first-class type of machine gun?"

Major-General LEONARD WOOD: "The Lewis gun has been adopted practically unanimously as the light gun of the British service and is being built for the French; and I think it is safe to say, when you see great nations struggling for life adopt a gun, that they are not adopting it lightly."

Transcript from the hearing before the U. S. Senate Military Committee, January 31st, 1917.
From Army and Navy Register

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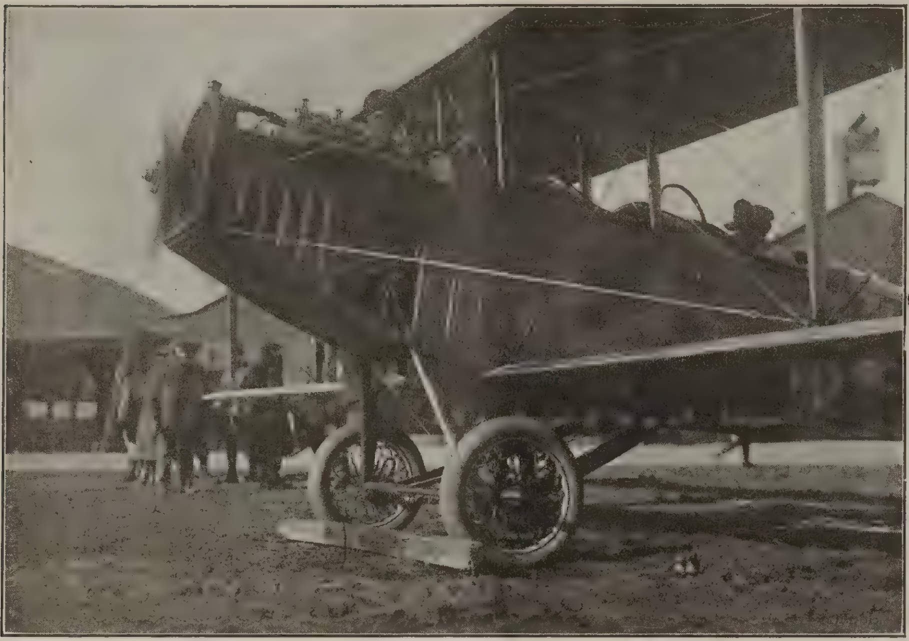

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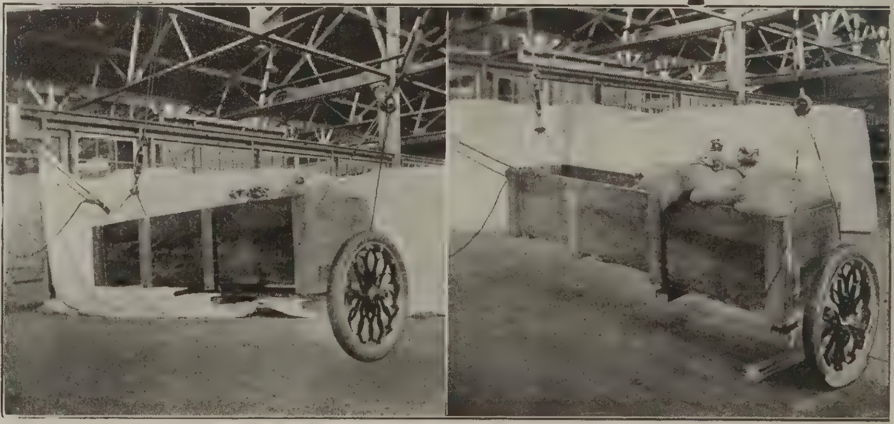

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WEEKLY

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VOL. V NEW YORK, APRIL 9, 1917 No. 4

"2,000 AVIATORS BY DECEMBER AND AIR MINISTRY" MOTTO OF AERO CLUB OF AMERICA'S ANNUAL BANQUET WHICH WAS ENTHUSIASTIC RALLY FOR NATIONAL PREPAREDNESS

WITH "two thousand military aviators by December," the eleventh annual banquet of the Aero Club of America turned into an enthusiastic rally for national preparedness which resulted not only in adding impetus to the movement for aerial preparedness but also to the presentation by Rodman Wanamaker of an armed air cruiser and a fully equipped aerial coast patrol station for the aerial protection of New York.

Close to six hundred people attended the banquet, which was held at the Waldorf-Astoria Hotel on March 30th.

Mr. Alan R. Hawley, president of the Aero Club of America, presided and Mr. Henry A. Wise Wood, chairman of the National Advisory Committee on Aeronautics, was toastmaster. The speakers included Hon. James W. Gerard, former Ambassador to Germany; Major General Leonard Wood, U. S. A.; Rear Admiral Robert E. Peary, chairman of the National Aerial Coast Patrol Commission, Mr. Stephane Lauzanne, editor of the Paris *Le Matin*; Congressman Murray Hulbert, Major Carl F. Hartmann, Signal Officer, Eastern Department, U. S. A.; Henry Woodhouse, member Board of Governors, Aero Club of America, and Godfrey L. Cabot, president, Aero Club of New England.

Mme. Geraldine Farrar sang the "Star Spangled Banner" during the standing toast to the Commanding Chief of our Army and Navy.

Other guests besides the speakers at the guests' table were: Henry B. Joy, vice president, Navy League; Hon. Thomas D. McCarthy, George W. Dunham, president, Society of Automotive Engineers; Commander Charles L. Poor, New York Naval Militia; Lieut. L. V. D. Herbster, U. S. N.; Elmer A. Sperry, Evert Janson Wendell, Robert Bacon, president of the National Security League, Glenn H. Curtiss, August Belmont, F. L. V. Hoppin, W. W. Niles, Col. I. N. Lewis, U. S. A.; W. W. Miller, William Berri, Captain Robert A. Bartlett, Cortland Field Bishop, Maurice Leon and Augustus Post. Telegrams and messages were received from many representative national defense workers and authorities, including Secretary of the Navy Daniels, Orville Wright, Senator Tillman and others.

Theodore Roosevelt said, among other things: "Believe me, I appreciate what the Aero Club is doing."

Senator Benjamin R. Tillman, chairman, Committee on Naval Affairs, United States Senate, wrote:

"Tell the assembled guests that America, in a very solemn hour of her history, expects every man to do his duty—and that she knows the airmen will not disappoint her. The men who will be sitting around the banquet table are the brothers of the Rockwells and others who have made the American name a symbol for daring in France, and if America calls, we know that they will render her yeoman service. Long live the Aero Club!"

Mayor Mitchel wrote:

"I am entirely in sympathy with the purposes of the club."

Second Assistant Postmaster General Otto Praeger wrote:

"It would be difficult to exaggerate the importance of the work which the Aero Club of America is doing in behalf of aviation, and I shall always be glad to render any possible assistance to the club in its laudable efforts."

Brigadier General R. K. Evans, U. S. A., sent a message from San Francisco, reading:

"I take great pride and pleasure in my connection with the Aero Club, and the little I have been able to do to assist in its work. I am glad to say that I believe that the Aero Club has accomplished its work towards preparedness with more thoroughness and completeness than any other instrumentality in the entire proposition, since we partially awoke to the fact that the United States is an unarmed and defenseless croesus in a world of hungry, fully armed and organized bandits. I expect to go into camp permanently in Washington, next October; and I hope then to do my 'bit,' as the Britisher says, in helping along the great work to which our club has given its heart and mind, with such eminent success."

Governor Charles B. Whitman, of New York, wired as follows:

"I am deeply appreciative of the work of this organization. Under modern military conditions the development of aeronautics is of vital importance to the defense of the nation."

Charles D. Walcott, chairman of the National Advisory Committee on Aeronautics, who expected to be present but was held in Washington by the present business connected with developing the air services, in his telegram advised the club to *"urge most strongly aerological surveys over North America and adjoining waters for the protection of lives of aviators, safety of aircraft and efficiency of action. At present practically nothing is known of the movement of the fluid in which shortly thousands of aircraft, representing millions of investment and more important, thousands of trained exceptional men will be operating."*

Emerson McMillin, the New York banker, who served in the Civil War with five of his brothers, and has spent $300,000 to develop national preparedness, in his communication, copy of which is enclosed herewith, praises the Aero Club of America for its "indefatigable and efficient work for national defense," criticizes the muzzling of Rear Admiral Bradley A. Fiske, who was not present at the banquet having been forbidden by Secretary of the Navy Daniels to address the gathering, and concludes quoting the following sentence of an editorial from one of the metropolitan papers.

"Under existing conditions, Daniels is a crime, and Baker is a blunder."

Congressman Charles Pope Caldwell telegraphed as follows:

"I am actively engaged in the preparation of a bill to create a department of the air headed by a secretary who is to be a member of the Cabinet. It is my belief that the war will be determined by the effectiveness of the aircraft and we of America who were the pioneers in this art should be the first as a power. In this respect the Aero Club of America has done much to awaken the country to this situation, and I trust they will continue the good work and assure you of my desire to cooperate with you."

Howard E. Coffin, a governor of the Aero Club of America and member of the Council of National Defense, wired as follows:

"I desire to congratulate the club upon its share in the development of aeronautics during the past year and impress upon our members the seriousness of the need for the most active and sincere cooperation, both with the military departments and with the newly formed Manufacturers' Association. The influence of the Advisory Commission of the Council of National Defense will be exerted in favor of the adoption of a three year construction programme with a definite assignment to each manufacturer of his part in the work. We must have standardization so far as possible in materials and in the details of design, and the number of models assigned to each factory must be reduced to a mini-

mum, it is only through a proper classification and concentration of our industrial resources in this industry that we may hope to make definite progress in this art so vitally necessary in the defense of this nation.”

Assistant Secretary of the Treasury Bryon R. Newton's message reads as follows:

“I had hoped to be present and offer a word of congratulation to the members of the grand old Aero Club who have accomplished so much, and from whom so much is yet expected at this time when activities in the air are of such immeasurable importance to the nation. How marvelously our dreams have been realized and exceeded in the past decade! Ten years ago you and I were wild with enthusiasm when we saw Henry Farnum make his old biplane leap a distance of three hundred feet down at Asbury Park. Only five years ago we were bewailing the fates because our Government would not give material recognition or support to aviation. Today we have millions available for the purchase of aircraft and find ourselves unprepared to supply the machines and the aviators that are needed. From now on the Aero Club of America, more than ever before, must play an important part in stimulating and accelerating this important task of preparedness. I congratulate you on the fine work the club has done, and my best wishes and hearty cooperation go with you in the future.”

Recently Commodore R. P. Forshew, commanding the Naval Militia of New York, advised the club that he had asked the Navy Department to train two officers of the Naval Militia in aviation. The Navy Department answered that the naval aeronautic school at Pensacola is full and these officers could not be trained. Commodore Forshew appealed to the Aero Club of America for assistance and Mr. Hawley made an appeal for funds at a meeting of the National Special Aid Society, which resulted in raising $800. Commodore Forshew, in regretting that he could not attend the banquet, wrote:

“The money for the training of the two officers at the Curtiss Flying School was received from the National Special Aid Society promptly following your request. This is but another instance of the assistance which your club has given to the Naval Militia in its aeronautical work, all of which has been greatly appreciated. More power to you.”

Mr. Hawley proposed a toast “To our Country,” which was responded to by the assembled guests.

He then addressed the members of the Aero Club of America, the Automobile Club of America, the Society of Automotive Engineers and the guests, and welcomed them to the eleventh and largest dinner ever held by the Areo Club.

He said, in part:

“The club has accomplished more in the past year than in any two other years in its history. In 1916, through its efforts, the Army and Navy appropriations for aeronautics were raised from $3,000,000 to $18,000,000. To accomplish this two million pieces of literature were distributed and 200,000 letters dealing with facts were prepared.

“A few weeks ago the First Pan-American Exposition exclusively for aeronautics was held, and was a success from every standpoint. Governor Whitman opened the exposition, and club members were greatly pleased with the tribute paid the club when he said:

“ ‘The preparedness we now possess is due to the determined insistence of a minority. And not the *least* of the forces that have fought for the wise thing, reading the future with clearer vision than their fellows, has been the Aero Club of America. Its task has not been easy, for of my own knowledge I know that its progress has been blocked by every misunderstanding, but never at any time has there been a hint of discouragement; any cessation of dynamic effort. And if no other result has been achieved, the existence of the Aero Club would be justified by this exposition that now gathers and directs not only the aeronautical genius of the United States but of our sister republics.’

“You all know of the club's many activities and I will not speak about them now.

“The Collier Trophy Committee unanimously recommends that the Collier Trophy for the year 1916 be awarded to Elmer A. Sperry and Lawrence B. Sperry for the development and demonstration of the Sperry drift indicator.”

Sperry Awarded Collier Trophy

Mr. Hawley then announced the award of the Collier Trophy, which is awarded annually for the greatest achievement in aviation in America, the value of which has been demonstrated by use during the preceding year, to Mr. Elmer A. Sperry and Lawrence B. Sperry for the development and the demonstration of the Sperry drift indicator.

Medals of Merit Awarded

Mr. Hawley also announced the award of the Aero Club of America's medal of merit as follows:

To Miss Ruth Law, American distance record cross country, November 19, 1916, 512,123 miles.

Philip A. Carroll, for his patriotic work in training military aviators at Governor's Island, 1916.

Floyd Smith, American hydro altitude records: January 12, 1916, one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 15, 1916, three passengers, 9,603 feet.

Corporal A. D. Smith, U. S. A., American hydro duration record, Feb. 19, 1916, 8 hrs. 42 mins.

Captain C. C. Culver, U. S. A., for wireless experimentation, 1916.

James V. Martin, for the invention of the aerodynamic stabilizer.

Aerial Coast Patrol Unit No. 1, for its pioneer work in developing aerial coast defense.

In recognition of aviation service rendered at the Mexican Border, 1916: Major B. D. Foulois, Capt. J. E. Carberry, Capt. W. C. Kilner, Capt. Ira D. Rader, Capt. C. C. Chapman, Capt. H. A. Dargue, Capt. R. H. Willis, Capt. T. S. Bowen, Capt. E. S. Gorrell, Capt. A. R. Christie, Capt. T. S. Dodd, U. S. A.

Victor Carlstrom, three additional bars to Medal of Merit he already holds.

American Altitude Records:
April 30, 1916, one pasenger, 16,225 ft.
April 10, 1916, two pasengers, 11,180 ft.
American Distance Cross Country Record:
May 20, 1916, one passenger, 283.02 miles.
Winning of the Curtiss Marine Flying Trophy for 1916.

T. C. Macauley, three additional bars to Medal of Merit he already holds for:

American Distance—Closed Circuit Record:
May 4, 1916, five pasengers, 154.08 miles.
American Hydro Altitude Records:
May 4, 1916, five passengers, 775 ft.
April 30, 1916, six passengers, 875 ft.
American Hydro Duration Record:
May 4, 1916, five passengers, 2 hrs. 23 min.

Ambassador Gerard Praises the Aero Club's Work and Points Out Need of Aerial Preparedness

Ambassador Gerard said, in part:

I am not used to making speeches. For the last two years I have been trying to keep three things, peace, silence and my temper. Besides, I rather sympathize with the Prussian General who said that he preferred taking a thousand yards of trenches to making a speech.

You gentlemen in the Aero Club are to be especially congratulated at this time because of the work you are doing, not only missionary, but actual. You have provided training for one hundred aviators in the last eighteen months.

What use is a man in a street fight who has no eyes. What use is an army, however well equipped and drilled without a modern Army's eyes—its aviators.

Modern war is largely a matter of mechanics and munitions.

Nevertheless we hear even to-day prattlings about embattled farmers taking their old muskets from over the chimney piece and defeating the invader. But nowadays the old flint-lock means Zeppelins, aeroplanes, captive observation balloons, steel helmets, gas and gas masks, machine guns, searchlights, sixteen-inch guns and eighteen-inch howitzers, trench mortars, range finders, telescopes, armored automobiles, tanks, miles of barbed wire, underground mining, rockets and grenades and countless other instruments of war, the proper use of which can only be learned after years of hard application.

The legend of the embattled farmer is responsible for much unpreparedness. Suppose the embattled farmers were called to war hurrying armed with squirrel rifles (whatever that means) in their Ford flivvers to repel the invaders.

Why, before they even sighted the enemy they would be bombed by planes and Zeppelins, gased, hammered with trommel fire, while a curtain of fire in their rear prevented their escape—from fifteen miles sixteen-inch guns would pound them to jelly—the embattled ones would never see the infantry of the foe.

All these modern means of war require great preparation. And in the most important—the primary branch of aviation **you of the Aero Club of America have gallantly taken the lead. The whole country is grateful to you.”**

Besides the gentlemen already mentioned there were present practically all the aeronautic authorities.

Rodman Wanamaker Presents Large Air Cruiser for Aerial Defense of New York—August Belmont Presents a Paul Schmidt Hydroaeroplane

Mr. Hawley read Mr. Rodman Wanamaker's letter offering a large armed aerial cruiser for the aerial defenses of New York, with a trained pilot, and the fully equipped aerial coast patrol station at Port Washington, L. I., which appears elsewhere in this number.

August Belmont presented to the club a Paul Schmidt hydroaeroplane equipped with an American motor, to be used for training purposes, a duplicate of which has been presented to the Navy Department.

Air Ministry Urged

The establishing of a Department of Aeronautics, with a Minister of the Air, was urged by Rear Admiral Peary, Congressman Murray Hulbert and Congressman Caldwell and the proposal received enthusiastic applause.

RODMAN WANAMAKER OFFERS LARGE AIR CRUISER FOR AERIAL DEFENSE OF NEW YORK—PROPOSES DEPARTMENT OF AERONAUTICS AND AIR MINISTER

RODMAN WANAMAKER has once more shown his public spiritedness and practical patriotism. He has presented to the Government through the Aero Club of America, the use of a 400 h.p. Curtiss air cruiser, completely equipped, and the well appointed coast patrol station at Port Washington, Long Island, for the protection of New York.

Mr. Wanamaker's letter making the offer, which was read at the Aero Club of America banquet, reads as follows:

New York, March 30, 1917.

Alan R. Hawley, Esq.,
President, Aero Club of America,
297 Madison Avenue, New York City.

My dear Mr. Hawley:

Six months before the terrible war broke loose in Europe, you will remember I wrote you under date of February 4, 1914, a letter of which the following are some excerpts:

"In the cause of science and in the interest of world peace, I have the honor to announce first of all to the Aero Club of America, my intention to make a purely scientific test of aeronautic power by crossing the Atlantic Ocean by one flight if possible.

"I have said this undertaking is in the interest of world peace. Let me explain what I mean. Once across the ocean in one flight of an aircraft and the nations of the earth will awaken to a realization of the tremendous importance aeronautics may prove to be to every nation.

"This year we are celebrating a hundred years peace between Great Britain and the United States, and it would be a fitting climax to this celebration, if those two countries could link themselves more closely together by this international flight across the ocean, demonstrating to the world that the time for disarmament of nations is at hand, if for no other reason than that because aeronautics has reached a stage where even the greatest dreadnaught battleships may become futile in their power.

"The crossing of the Atlantic by air is not a matter merely of initiative, nor of daring, nor even of skill; it is a problem of science."

The above extracts, written in 1914, will again recall to your attention the importance of the fact that immediate, intelligent and efficient action should be taken in the formation of aeronautic stations throughout the length of our coast, to be equipped with proper guns, and with men trained for coast defence. This important action can best be accomplished by the patriotism of our citizens, who, realizing the importance of the work, should immediately build such stations, ready to be used by the Government for coast defence.

In August, 1914, I was in London, awaiting news that the "America" had been thoroughly tested, and hoped to greet Commander Porte on his arrival in Great Britain. When it became apparent that there was to be war, he immediately returned to his country. In the interim, have been busily engaged in perfecting still larger machines and studying scientific methods of importance to such an extent that at the present moment, undoubtedly there are under construction the best machines in the world, which will be ready to take their part.

During the past year I have established aviation training stations at Port Washington, L. I., and Palm Beach, Fla., and have already donated the use of the Palm Beach station for the training of men for Government aeronautic service. I now wish to add to the equipment of my Port Washington Station one air cruiser of the "America" design, fitted with two 200 horsepower motors, a suitable aeroplane gun and a well trained pilot and a capable mechanic (both already in my employ) and to offer through you to the Government, for as long a time as they desire, the air cruiser, the pilot and mechanic. The Government will undoubtedly want to furnish the gunner, etc. This will give the Government the first Coast Patrol Station in America equipped with an armed air cruiser capable of hunting submarines, locating mines and convoying troopships, and will give New York City its first real aerial protection.

In March, 1916, a special messenger was sent to Washington, to both the army and navy departments, with all blue prints and details of information in my possession relating to work that was still in progress, so they would be fully informed, and since that time still further progress has been made.

All of the information now in possession of the Government, from whatever source derived, covering this vast field of vital importance, should be gathered together under the direction of a most capable man, a Cabinet officer of the United States, the Secretary of Aeronautics, and who, understanding business methods, can formulate and organize a substantial air service without the loss of unnecessary time at this intense moment. Very sincerely yours,

(Signed) Rodman Wanamaker.

Photographs and the description of the Curtiss air cruiser were printed in the last number of AERIAL AGE.

AERO CLUB ENTHUSIASTIC OVER PRESIDENT'S MESSAGE

THE President's message was received with great enthusiasm at the Aero Club of America. The Board of Governors held a special conference on the evening of the message and decided to promptly take steps to mobilize the civilian aerial resources, preparing same for the Army and Navy to take up. The club has received close to 3,000 applications from men who would like to learn to fly, about two hundred of which are men who are willing to pay for their own training and purchase their own aeroplanes, so as to be available to meet an emergency. As neither the Army nor Navy have facilities to train more men, the club has been developing plans to establish a chain of aviation training schools and is ready to carry the plan into effect as soon as it receives word from the Army and Navy.

Messrs. Alan R. Hawley, Rear Admiral Bradley A. Fiske, Rear Admiral Robert E. Peary, Henry Woodhouse, John Hays Hammond, Jr., Eugene S. Willard and Dr. Schuyler Skaats Wheeler have been occupied in the past week formulating plans for the aerial defences of the Third Naval District, having been asked to do so by Rear Admiral Nathaniel R. Usher, the Commandant of the Third Naval District.

THE NEWS OF THE WEEK

Princeton Gets Two Aeroplanes

Princeton, N. J., March 31.—That Princeton will have aircraft hovering above it in a not far distant time is not a rash conjecture. Two flying machines already have been given to the Aviation Corps of the university by a graduate and are expected to arrive in the university town within a few weeks' time. Moreover, several more machines have been promised to the undergraduates by the alumni body.

Dr. Joseph Raycroft, of the university faculty, is organizing the corps. He has already selected a field in Princeton for the work and is securing several instructors and mechanics to assist the students in their training. It is probable that the aviation schools will be conducted through the summer months. Several Princeton men, including Hobey Baker, football and hockey player, and June Salmon, baseball player, are already in the aviation service of the Government. Since the break with Germany several undergraduates of the university have joined government aviation schools.

Yale Aviators Training

The twenty-eight Yale students, who left recently for training in aviation at Palm Beach, have been thoroughly schooled before being assigned for flying. They have been studying the art of aviation as part of their regular work at the university, and recently employed the services of O. B. Whitaker of the Sperry Gyroscope Company, as their instructor in aerial navigation.

The instruction in aviation was begun after a group of Yale students, capable of providing aircraft, consulted with the university authorities. The latter readily gave their approval of the plan and arrangements were made for the work to count as part of the required schedule, even though aviation is not a required subject for a degree from "Old Eli."

Prominent among the students who started the Yale flying class is Trubee Davison, son of H. P. Davison, a member of the firm of J. P. Morgan and Company. The younger Mr. Davison has been actively interested in flying for some time and he soon worked up enthusiasm among his college mates, including A. Lovett and others from families equally prominent in American business.

After organizing themselves into a class, these Yale aviators engaged Mr. Whitaker to become instructor in the art of navigating the air. The course, which was mapped out for the students under his supervision, included thorough training in that art, particularly the use of the most up-to-date aerial navigating instruments, such as automatic pilot, synchronized drift set, and Creagh-Osborne compass. With this apparatus Mr. Whitaker has been able to give demonstrations at the same time he describes their uses.

Benoist School Open for Season

Sandusky.—If all signs do not fail that part of Lake Erie around Sandusky Bay will probably see more hydro-aeroplane activity than any other part of the great lakes. The Benoist Aeroplane Company, located at Sandusky, Ohio, are preparing to open their Summer School on April 5th with more than a dozen students and about three flying boats, besides that, arrangements are being made for a regular scheduled passenger line making ten trips a day between Sandusky and Cedar Point and another passenger line making a round trip in the morning and a round trip in the afternoon to Put-in-Bay, also a line between Sandusky and Detroit. For the Detroit run they expect to put in a twin motored seven-passenger machine and will make two or more round trips a week.

Army and Navy News

First Lieut. Arthur J. Coyle, Aviation Section, S.O.R.C., to active duty at Signal Corps Aviation School, Mineola, Long Island, N. Y. (March 24, War D.)

First Lieut. Birdeye B. Lewis, Aviation Section, S.O.R.C., to active duty at Fort Sam Houston, with 3d Aero Squadron. (March 23, War D.)

The 6th Aero Squadron, Signal Corps, will proceed to Fort Kamehameha for station. (March 12, H.D.)

Sergt. 1st Class Ernest E. Hagelin, Aviation No. B, Signal Corps, Aviation School, Mineola, Long Island, N. Y., is transferred to the C.A.C. 5th Co., Fort Totten, N. Y., as private for duty. (March 19, E.D.)

The following sergeants of the Signal Enlisted Reserve Corps from active duty in Aviation Section at the Curtiss Aviation School, Newport News, Va., March 25, 1917, to their homes: Sergts. Walter V. Barneby, Edward R. Kenneson, William T. Rolph and Howard P. Culver. (March 22, War D.)

S. A. E. to Change Name April 19

New York.—In order to further standardization work in connection with Government preparedness work, the Society of Automobile Engineers will change its name April 19 to Society of Automotive Engineers. At that time the engineers who were formerly members of the American Society of Aeronautic Engineers, the Society of Tractor Engineers and engineers connected with the company members of the National Assn. of Engine and Boat Manufacturers will be working together with those who have been members of the Society of Automobile Engineers, always with the welfare of the nation at this time held constantly in view. The culminating decision to change the name was based on government cooperation in time of stress.

The Preparedness Committee of the S. A. E., consisting of President G. W. Dunham, past President W. H. Vandervoort and Vice-President J. G. Vincent, is not only making a classification of the society members with reference to qualification to cooperate with the government and keeping in close touch with various Government officials, but is taking an active part in the big plan under way to increase the membership, drawing upon engineers in the various automobile fields.

Duesenberg Motors Refinanced

New York.—The Duesenberg Motors Corp., has succeeded the Duesenberg Motor Co., St. Paul, and the Loew-Victor Engine Co., Chicago, its capital being $1,500,000, of which $1,050,000 is paid in. The company has located a plant in the East at Edgewater, N. J. The engineering and experimental forces have already been moved from Chicago and the company will, in a short time, be building on a commercial basis a line of Duesenberg motors for both automobiles and aeronautical purposes, devoting the output of the Chicago plant to marine models. The Loew-Victor Engine Co. has been building one of the largest high-speed marine motors on the market for the past year. These motors were designed by F. S. Duesenberg. The Chicago plant will in the near future be consolidated with the Edgewater plant.

The personnel of the organization is as follows: Directors, J. R. Harbeck, F. S. Wheeler, Charles Stollberg, K. S. Breckenridge, L. A. Welles and F. B. Page. The first five are all of one of America's largest industrial corporations. Mr. Page is vice-president and general manager of the E. W. Bliss Corporation.

J. R. Harbeck, who has been president of the Loew-Victor Engine Co. since its formation, is president and managing director of the Duesenberg Corporation. E. L. Decker is assistant to the president; H. A. Wing is secretary and treasurer; C. B. Page is general manager in charge of production, and N. G. Rose is general sales manager. F. S. Duesenberg is chief engineer. A. S. Duesenberg is assistant engineer. M. M. Whitaker is assistant engineer and naval architect. G. A. Beilstein is purchasing agent and F. E. Lampe is superintendent.

Personal Paragraphs

M. H. Needham has resigned as general manager and treasurer of the Bailey Non-stall Differential Corporation. He has become associated with the Barrett-Cravens Company, manufacturers of the Barrett Multi-truck, time clocks and other factory equipment.

Army Fliers Hunt U-Boat Off Long Island

New York.—For the first time in the history of American military aeronautics American aeroplanes flew last week over our coast line to guard against the attack of enemy submarines. Theory was omitted. German U-boats were believed to be off Montauk Point. Four fliers from the government school at Mineola—Instructors Leonard Bonney, B. B Acosta, A. S. Allen and A. W. Briggs—were detailed to spend three days away from their base in looking for them.

It was not work stimulating the conditions of war. It was under a reproduction of the conditions of warfare.

Last Tuesday morning these four fliers rose from the Mineola field in a forty-mile an hour gale and a bad fog. They were detailed to patrol the Long Island coast from Oyster Bay to Montauk Point, while Governor's Island aviators watched over the shore from the island to Oyster Bay. Two of the men, Acosta and Briggs, were out for three days. They did

The Navy Aeronautic Station at Pensacola, Florida not return to their headquarters, merely landing when they were forced to. A new supply of gasoline was obtained at the dealer's nearest to the place of landing. During the night the 'planes were left in the field in which they had landed, while the pilots slept in the nearest inn.

The fliers were detailed to watch for submarines—an experinment which the officers at Mineola have been intending to make for some time. The belief that undersea craft had been sighted near Montauk Point made the patrol work more than an experiment.

Torpedo boats and smaller craft were easily sighted by the aviators. They saw no submarines, but declared that the sandy bottom in that part of the Sound would have made the detection of U-boats a simple matter.

On his second day out Bonney's engine went dead when he was flying near Melville. He was forced to land as best he could. He came down in the limbs of a tree. The pilot was unhurt, but the aeroplane had to be taken to pieces in order to get it back to the field.

Allen's supply of gasoline gave out on his first day, when he was flying over the water near Crane Neck Point. The stiffness of the breeze prevented his gliding for a long distance, and his craft landed in shallow water near the shore.

The Goodrich "Blimp"

By permission of the Secretary of the Navy the following description of the Blimp dirigible balloons, which the B. F. Goodrich Company is building as rapidly as possible for the Government so that they may be available for war scout work, is made public:

"The shape of the envelope of the Blimp dirigible somewhat resembles that of a cigar. The entire length, from tip to tip, will be 160 feet and the maximum diameter 31.5 feet, but the maximum width over the tail fins will be 36.2 feet. This huge envelope will displace 77,000 cubic feet.

"Suspended from the envelope will be a rigidly built car, spacious enough to carry a pilot, an observer, the necessary accessories for determining altitude, speed, etc., and a 100-horsepower gasoline motor of the latest improved type. Provision is also made for carrying ballast, which, when thrown out, will enable the dirigible to reach an altitude of 7,500 feet with safety.

Wardrop Addresses Cleveland S. A. E.

Cleveland: At the March meeting of the Cleveland Section of the S. A. E., G. Douglas Wardrop, Editor of AERIAL AGE, gave a talk on "Aircraft in the Great War," illustrated by stereopticons and motion pictures, and showing the evolution of the application of aircraft in war service. The engineers were enthusiastic concerning the presentation, and considerable feeling towards the organization of an Aero Club in Cleveland was generated.

Mr. Wardrop also addressed the Engineering Society of Cleveland at luncheon, and there also great interest was evinced in the subject.

Aeronautic Division S. A. E. Meets

Buffalo: An important session of members of the Aeronautic Division was held in Buffalo on the 16th, Chairman Manly, Captain V. E. Clark, C. B. King, J. G. Vincent and Coker F. Clarkson being present.

With reference to the question of the system of measurement to be used basically in expressing dimensions of aeronautic standards, it was the sense of those present that it will be necessary to continue the use of the inch system in connection with hex stock sizes, bolt and screw sizes and threads (except spark-plug shell thread), gear cutters, gear centers and reamer sizes. The matter of spark-plug standardization for aeronautic engines was taken up again, the previous recommendation of the Division having been referred back by the Council owing to apparent discrepancies. It is felt that in addition to specifying the 18-mm. diameter 1.5-mm. pitch thread for the spark-plug shell, the length of this threaded portion should be specified as 16 mm. A specially appointed committee of the Division will report on the question of tolerances for diameters. It is expected that all of the other aeronautic spark-plug dimensions will be expressed in inches.

Taking up the question of propeller-hub capacity, the opinion was expressed that this should be based on torque and not on horsepower. Messrs. Vincent, Caldwell and Manly will submit a report on specification of propeller-hubs of various capacities, propeller-hub locking fittings and on stresses in propellers.

The following dimensions (in inches) for engine supports were recommended:

Distance between timbers........	12	14	16
Width of bed timbers............	2	2¼	2½
Distance bet. centers of bolts	14	16¼	18½

(anchor bolts to be ½ in. diameter)

According to the last action of the Division, the direction of engine rotation should be designated according to the following statement:

"The direction of engine rotation is normal when the final power delivery member of the engine rotates anti-clockwise, viewed facing the power-delivery end. Opposite rotation is anti-normal."

The terms suggested would not be in accord with the latest recommendation of the National Advisory Committee for Aeronautics and no final action will be taken until the views of the two bodies can be harmonized. One important consideration is that on multiple-engined machines having two or more propellers, the engines are frequently described as "right-hand" and "left-hand," depending on position in the machine; while at the same time the engines are likely to be made to rotate in either direction regardless of position, because air-blast may be needed over or under the stabilizer. The great advantage of the terms recommended by the Division ("normal" and "anti-normal") to indicate engine rotation, is that whereas they are well known descriptive terms, they have never been used in connection with engine rotation, and there is therefore no possibility of conflict with past practice in the aeronautic or allied industries. In the case of dual-engined machines there has been considerable confusion from misunderstood use of "right-hand" and "left-hand," as to whether position on machine or rotation of crankshaft was meant. The use of the terms recommended by the Division will conflict in no way with the designation of right- and left-hand propellers as heretofore in past practice.

Following the action of the Marine Standards Division, the Aeronautic Division has checked over in part the list of S. A. E. standards established for automobile practice, as to suitability in aeronautic practice. The S. A. E. standard screws and bolts are applicable for the general run of work, but there should be supplemental standardization of heads and nuts for use where lightness is requisite and to minimize air resistances. C. B. King, F. G. Diffin, and E. H. Ehrman have been appointed a special committee on this subject.

The S. A. E. steel specifications are considered applicable, but an additional screw stock specification is suggested.

In addition, the following S. A. E. standards are considered applicable in aeronautic practice:

Heat treatments, test-specimens, ball-bearing sizes, Throttle levers, carbureter flanges, magneto dimensions, cotter-pin sizes.

The aeronautic engineers wish to check up carefully the S. A. E. standard of piston ring groove dimensions.

It is felt that the S. A. E. flared tube unions cannot be considered applicable now in a final way and there is a difference of opinion as to the type of gasoline lead which will prove most effective at an early date in aeronautic engine practice.

The opinion has been expressed that the S. A. E. ells and tees are too heavy for use on aeroplane engines.

A flange for use in mounting twin carbureters has never been standardized by the Society. This question will, however, be taken up by the Aeronautic Division.

The Division expects to take up definite consideration of the following subjects at an early date, its next regular meeting being scheduled for April 20: turnbuckles, wire ends and eyes, shackles and rod end pins, clip ends, fabric test specifications, dope and varnish specifications, handpumps and drain-plugs for pontoons, high-grade thin-wall tubing, tachometer connections, wing attachments, controls, screw test specifications, safety belt, marking gas and oil lines, performance test, hand air-pumps and water connections. Special committees have been appointed on practically all of these subjects.

Foreign Pilots Get Licenses

Redwood City, Cal.—Graduation exercises for the Christoffersen Aviation School were held recently under the direction of Guy H. Slaughter, representing the Aero Club of America. Pilot licenses were granted James Martin of Vancouver, B. C., and Arthur Gulbera of Guatemala.

Mrs. George French Shelton, of Butte, has enrolled as a student of the Christoffersen Aviation School. She says it will be at least ten weeks before she can motor back to Butte, and she will put in the time learning to fly.

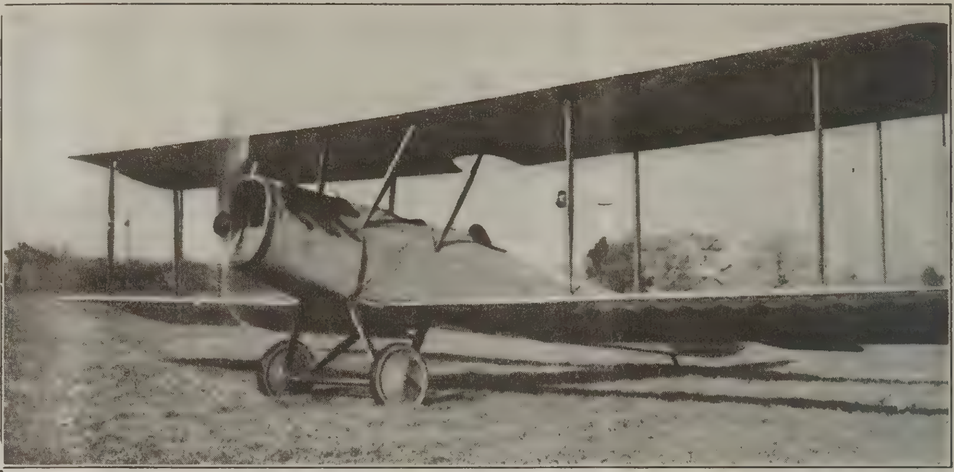
College Athletes to Enlist

Philadelphia.—James E. (Ted) Meredith, famous former Pennsylvania athlete and holder of the world's quarter and half mile running records, has announced that he intends to enlist in the aviation corps, and is arranging his business affairs so that he can start taking instructions as soon as he is accepted.

Donald Lippincott, former Pennsylvania track star, along with several other Pennsylvania athletes, has also signified his intention of joining with Meredith.

The Congressmen who recently visited the Army Aviation School at San Diego, Cal. Left to right: Admiral Coperton, Commander of the Pacific Fleet; Congressmen C. H. Dillon, H. Z. Osborne, T. L. Ruby, E. W. Roberts, T. F. Butler, L. P. Padgett, William Kettner, and Colonel William Glassford.

WRIGHT-MARTIN MODEL V TRACTOR



THE splendid Wright-Martin, 150 H.P. Reconnaissance Tractor is the first Hispano motored aeroplane to be designed and flown in America. It is a recent effort of Mr. Chance M. Vought, whose versatility as an aeronautic engineering director and designer is shown by a long list of remarkable aircraft successes, including the famous Mayo biplanes.

This Wright-Martin 2-seater was exhibited at the 1916 Aero Show, where it excited universal favorable comment because of its fine design, simplicity and modern production possibilities.

Rapidity of production has not always been considered in machines which have been designed to be efficient dynamically. In the Model V, the ease with which fittings could be manufactured was given the same attention as the design of the machine as a whole. Fittings are substantial throughout, and in most cases are steel stampings, embossed and die formed from special steel, heat treated.

In the issue of AERIAL AGE of February 5th, a complete description of the Model V was given, together with detailed specifications and photographic illustrations. A general summary of the description is given below to enable a better understanding of the characteristics of design shown in the accompanying outline drawing.

General Dimensions

Span, upper and lower planes	39′-8½″
Chord	5′-9½″
Gap	5′-7″
Length over-all	27′-2″
Height over-all	9′-5½″
Weight, complete, without fuel	1725 lbs.
Useful load (pilot, observer, supplies)	595 lbs.
Weight of fuel for 6 hours' flight	460 lbs.
Motor, Simplex Model A Hispano-Suiza	150 H.P.

Planes

The planes are staggered, the upper being 12″ in advance of the lower. Dihedral angle, 1 degree 45 minutes. There is no sweepback. Upper plane composed of three sections and lower plane of one section butting into either side of the fuselage.

Ribs are built up with spruce battens and poplar webs, glued and nailed together and reinforced to prevent longitudinal shear. Leading edges of plane are of spruce; trailing edges of white ash. Main spars of I section spruce.

Area of upper plane, exclusive of ailerons, 223.2 sq. ft. Lower plane, exclusive of ailerons, 206.8 sq. ft. Area of the four ailerons, 64.6 sq. ft. Total area of supporting surface, exclusive of ailerons, 430 sq. ft. Loading per sq. ft., 5.86 lbs. Loading per b.h.p., 16.86 lbs.

Body

Rearward of the planes the fuselage tapers to a vertical knife edge, which serves as an anchorage for the fin and rudder. With the exception of the steel motor mounting, the construction is of ash and spruce logerons and cross members braced with Roebling's vanadium steel wire. In the forward part of the fuselage a substantial system of "follow-through" has been employed.

Covering near the motor and the curved top as far as the pilot's seat, is aluminum. Covering elsewhere of linen fabric. Quick access to the interior truss work of the body is permitted by the removal of a detachable deck.

The rear cockpit is provided with Dep control. On the dashboard are an altimeter, slip indicator, air speed meter, clock, oil and air pressure gauges, tachometer, thermometer, primer, shut-off valve, hand air pump and ignition switches.

Landing Chassis

The chassis is composed of two sets of ash V struts of streamline section combined with a streamlined system of twin-parallel steel spreader tubes. The struts are attached to the body with steel clip and pin fittings.

Axle is nickle-steel tubing specially heat treated. Wheels 26 by 4 inch. Tread of wheels, 5′-4″. Weight of the chassis complete, 86 lbs.

Tail Group

The horizontal stabilizer is double cambered, with rib structure constructed over an I section spruce spar located 14 inches back of the leading edge. External bracing to the forward part of the horizontal stabilizer has been eliminated by the use of this substantial spruce spar, besides providing for the necessary depth for the double cambered profile. Interbracing is secured by streamlined tubing outside stays so located and calculated as to take all the emoennage drift, control thrust and vertical loads.

Elevator and rudder ribs are sparred and the surfaces provided with a light spruce spar disposed 10 inches forward of the trailing edge to aid in equalizing the load on the ribs.

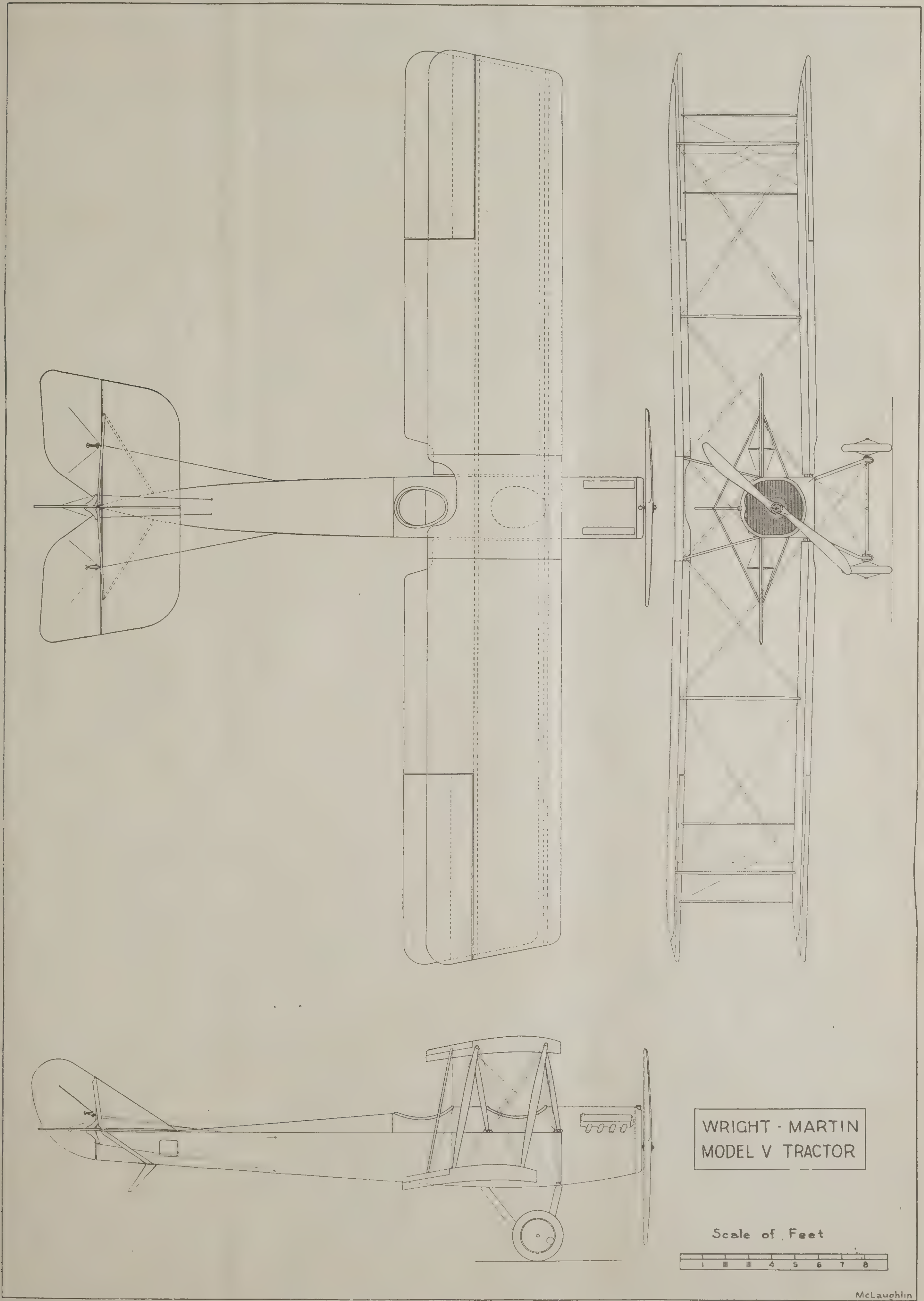
No welding operations are employed in making the frames, and all ribs and spars are attached to tubular frame members by sheet steel socketing clips brazed in place.

Motor Group

An article dealing with the Hispano-Suiza 150 H.P. motor, appears in this issue of AERIAL AGE. Its rated H.P. is developed at 1400 r.p,m. An oak propeller 8′-4″ in diameter and with a 5′-7½″ pitch rotates in a counter-clockwise direction.

Main fuel tanks are placed longitudinally and to the rear of the front seat in padded floor cradles. Fuel supplied by pressure to the service tank located in the cowl aft of the front cockpit.

The Wright-Martin Model V, piloted by H. S. Rinehart


WRIGHT - MARTIN
MODEL V TRACTOR
Scale of Feet
McLaughlin

THE CASE FOR THE LARGE AEROPLANE

By F. HANDLEY PAGE, A.F.Ae.S.*

(*Continued from page* 86)

Attention is drawn to the fact that the loading expressed in weight per unit of area, and the value of the density of the air expressed as weight per cubic unit of air, appear in the same form in both velocity and h.p. multiplying factors. It follows, therefore that these curves are correct for any loading or height above ground level, the comparison between the two being correct as long as the loading is equal in both cases. The only alteration is the multiplying factor of the horizontal and the vertical scales.

It is hardly correct, however, to compare two machines, one of which has a slower landing speed than the other. For correct comparison the slow landing speed of a machine fitted with planes to R.A.F.3 section should be increased so that it is the same as that for R.A.F.6. The area of the R.A.F.3 planes should be decreased, thus increasing the loading until the two slow speeds are identical. The loading is increased in the ratio of 1 to 1.05. To compare the resulting curves it is better to keep the multiplying factors of the vertical and horizontal scales the same and alter the R.A.F.3 curve. Since the loading enters into the multiplying factor of the h.p. and velocity scales equally each value of the R.A.F.3 curve must be increased 1.05, both as regards h.p. and velocity. A new curve is now obtained for R.A.F.3 having the same slow speed as R.A.F.6 and the multiplying factors being the same for both. These new curves will again be true for all heights.

We will take an actual practical example. Assume a machine weighing 2,200 lbs. with a loading of 5.9 lbs. per sq. ft., and that at the ground $p/g = 425$. Then from equation (4) $a = 50$ and from (5) $b = 200$. For R.A.F.3 the value of Ky (maximum) is .675, and of $1/\sqrt{Ky}$ is 1.215. For R.A.F.6 the value of Ky (maximum) is .605 and of $1/\sqrt{Ky}$ is 1.285. The slow landing speed of R.A.F.6 for the loading of 5.9 lbs. per sq. ft. is $50 \times 1.285 = 64$ ft. per second or 43.5 miles per hour. The slow landing speed of R.A.F.3 for the loading of 5.9 lbs. per sq. ft. is $50 \times 1.215 = 60.5$ feet per second or 41.2 miles per hour.

The new curve for R.A.F.3 will be for a slow landing speed of 43.5 m.p.h., and the loading will now be $\frac{43.5}{41.2} \times 5.9 = 6.25$ lbs. per sq. ft. Each point on the old R.A.F.3 curve must have its vertical and horizontal value increased in this proportion—*i.e.*, multiplied by 1.05. The new R.A.F.3 curve was plotted in this way.

The minimum height of either of these curves above the horizontal is the minimum h.p. required by the planes, and, neglecting body resistance, the curve with the minimum value will have the highest climbing speed. It must always be borne in mind that the curve with the higher loading will have the smaller planes, and therefore weigh less. Allowance must be made for this in effecting the comparison.

The three curves can now be compared. For the same loading and h.p. available R.A.F.3 has the slower landing speed, the higher climbing rate, but the slower top speed. If the loading be increased R.A.F.3 loses its advantage in climbing rate, and does not attain the same high speed as R.A.F.6. In a similar manner any other or more modern planes may be compared.

It is interesting to note, in passing, that at 10,000 ft. height where $p = .055$ the value of a will be increased to 59 and of b to 236. The effect of height is to reduce the h.p. required for any given speed, and also the speed range by increasing the slow speed. Owing to the h.p. scale being increased, the minimum h.p. required for flight is increased, and, therefore, quite apart from reduced engine h.p., the excess h.p. available for climbing is reduced.

The general range of velocities for a high speed machine is from 50 to 130 m.p.h. or 73.5 to 190 ft. per sec. In general the value of $1/\sqrt{Ky}$ will lie between 1.4 and 3.8. For a slow speed machine flying from 40 to 90 m.p.h. or 59 to 132 ft. per sec. $1/\sqrt{Ky}$ will vary between 1.1 and 2.7. Any comparison between plane curves must be made between the velocity limits of the type of machine considered.

So far the comparison has only been extended to the planes of a machine. The body resistance remains to be dealt with.

The equation may be written:—

$$\text{Resistance} = Rb \cdot \frac{p}{g} \cdot V^2 \quad . \quad . \quad . \quad (11)$$

$$\text{H.P. required} = Rb \cdot \frac{p}{g} \cdot \frac{V^2}{550} \quad . \quad . \quad (12)$$

This equation is identical in form with the plane h.p. curve. The term Rb is the product of the values of a resistance co-efficient Kxb and a body area S. The equation may therefore be written:—

$$\text{H.P. required} = Kxb \cdot \frac{p}{g} \cdot \frac{S}{550} V^2 \quad . \quad (13)$$

Whence inserting the value of V in equation (2) above

$$\text{H.P. required} = \frac{Ky}{Kxb}\sqrt{\frac{1}{Ky}} \cdot \frac{S}{A} \cdot \frac{W}{550}\sqrt{\frac{W}{A} \cdot \frac{g}{p}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

The H.P. required for body resistance can be plotted to the same scale as those for the planes. The values would be divided by

$$\frac{W}{550}\sqrt{\frac{W}{A} \cdot \frac{g}{p}} .$$

There would then be plotted for the body resistance H.P. the value of:

$$\frac{Ky}{Kxb}\sqrt{\frac{1}{Ky} \cdot \frac{S}{A}} \quad . \quad . \quad . \quad (15)$$

The h.p. required for body resistance can now be added to the plane h.p. curves. Let us assume that the machine referred to in paragraph 10 above requires 10 h.p. to overcome body resistance at 100 ft. per sec. Below the horizontal line has been added a curve of h.p. required to overcome body resistance, the scale of h.p. being the same as that for the planes. The total height between the two curves for any value of $1/\sqrt{Ky}$ gives the total h.p. required at that speed. It is interesting to note that these curves are correctly placed in respect of one another for all heights. This method of plotting and the curves so obtained give the necessary basis for a comparison between different machines, and reference will be made to them again later in the paper, after discussing the structural side of the question.

Twin-motor hydroaeroplane constructed by the U. S. Navy

The Effect of an Increase in Size on the Structural Weight of Aeroplanes

Attention has already been drawn to the fact that an improvement in the aerodynamical qualities of the machine as the size increases may be partially or completely nullified if the increase in size is accompanied by a disproportionate increase in weight. I will, therefore, accordingly examine the rate at which the weight increases with increase in size.

In this discussion we shall leave out the weight of the power unit comprising engine, tanks, and fuel, as well as the useful load, whether consisting of men or dead weight, such as guns, bombs, etc. We will confine our argument to the weight of the machine structure, that is, the portion which supports the load whether on the ground or in the air, with the necessary directing surfaces and their attachment to the main portion of the aeroplane. In the latter category come the planes, the fuselage, and the chassis, and these will be considered seriatim.

In all discussions on weight saving there is the general question as to the best utilisation of materials with the varying size of machines. As the machine is made smaller, so eventually a limit is reached beyond which it is not possible to decrease the minimum thickness of the material and retain adequate local strength. Especially is this the case in aeroplane work, where the members are usually stressed as struts, and for which, therefore, a hollow tubular construction is the most efficient form from the point of view of minimum strength for a given weight. In making tubular members, whether these be plane spars, fuselage, struts, or longerons, it is not advisable to decrease the thickness of the walls below 5-16 in. to 1-4 in. Even this is on the small side when allowance is made for errors in workmanship, and the fitting in of the necessary tongue piece to make a secure joint. Considerable economies can be effected in weight-saving with increase in size in this manner.

Local strength, too, determines the construction of subsidiary parts of the machine, such as the tail skid, the ribs, tail planes, a local strength that does not need to be increased with increase in size of the machine, and here, again, weight economy can be effected.

This better utilisation of material more than offsets the increase in weight that would occur in the planes provided that they were increased in a geometrically similar manner and the loading aspect ratio and section kept the same. In a machine of which I can show you the photos later the plane weight per square foot is less than a small one for the same factor of safety, and the total plane weight is a lesser percentage of the gross weight.

The fuselage weight, owing to the better utilisation of material, is considerably decreased The chassis weight remains about the same.

The Effect of an Increase in Size Upon an Aeroplane's Performance.

A general comparison can now be effected between aeroplanes of different sizes on the basis of the curves described in Section II., the total weight of the aeroplanes considered being modified according to the size in accordance with the conclusions of Section III. An examination of equation No. 9 in which H.P. equals $b \times Kx/Ky \times \sqrt{1/Ky}$ shows that, provided that similar planes are used and that the weight per H.P. remains the same, the same plane curve represents all machines. These curves as plotted are, in fact, curves of H.P. required per pound weight of the machine for a given loading per square foot. Let us now examine the lower curve of H.P. required for body resistance and refer to equation 14. Provided that the area of the body increases in the same ratio as the plane area, this lower curve will still, for any size of machine, be correct in relation to the plane curve ploted above, and the summation of the two ordinates or the distance between the two curves will represent the total H.P. required, the scale being increased in proportion to the increase in ratio. The greatest resistance of an aeroplane is that of the body. This, for smaller shaped bodies, would increase as the square of its lineal dimensions, whereas its volume would increase as the cube. It follows, therefore, that the resistance of the fuselage per unit of volume will decrease with the increase in size of the aeroplane. The lower curve will have to be modified to meet these changed conditions. This decrease in weight will have the usual cumulative effect of decreasing the weight of all the rest of the machine.

The curves which are plotted are for H.P. per unit weight of the whole machine, and do not show so graphically the superiority of the large machine as if the curves of H.P. per unit of useful weight had been plotted instead of gross weight. In this case the curves for planes and body would have their vertical ordinance increased with the proportion of useful to total weight. The balance in favour of the large machine is thus apparent directly we compare machines of approximately the same total weight per H.P.

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* *Lecture.*

The conclusion that may be drawn from the above theoretical considerations of the aerodynamical and structural qualities of the large machine are that for the same total weight carried per H. P. the big machine will effect the better performance.

THE LARGE MACHINE FROM THE PILOT'S STANDPOINT.

There has been very much less experience in the flying of large machines than with small ones, and, therefore, pilots are not so accustomed to their use, neither is the experience wide enough to draw general conclusions. It may, however, be safely said that large machines can be built to operate quite as easily and fly with as little fatigue as the best of the small ones. No Servo-motors are required for the controls provided the controlling surfaces are properly balanced. There is less work in flying a large machine owing to the wind gusts, which seem large to a small machine, being relatively small in their effect on a large one. A large machine will plough its way through gusts without any control being necessary, whereas a good deal of warping might be necessary on a small machine. The large machine can be handled more easily on the ground and can alight in smaller places.

When considered from the point of view of load to be carried or long distance to be flown the large machine has it all its own way. Where a large load is to be carried the size of the machine to do it must be increased until the useful load is sufficiently great. The size of the machine that is required for the purpose depends on the total weight per H.P. that can be carried. There is here no question of competition between large and small machines, it is a case of the correct machine for the purpose.

For future commercial developments the large machine scores with plenty of room for passengers to sit in comfort, or mails or luggage to be carried, and with its steadier movement will afford great comfort to those who travel by it. It is probable that commercial aeroplane work will be undertaken for long-distance journeys. Where delays at the commencement of the journey are a large percentage in time of that necessary to complete the distance, the possible time taken to traverse a given space may be as great or even greater than that taken by a more certain means of transit. It is the old question of the hare and the tortoise. Where, however, the distance to be traversed is great, such as 1,000 to 2,000 miles, or with journeys such as crossing the Atlantic, the passengers or mails could afford to wait a day or two and will accomplish the journey far quicker than any other means of transit. Were the commercial development of aviation confined to journeys of from 50 to 200 miles, delays at starting or the cost of organising to prevent them would cause the aeroplane's use to be considerably nullified.

It is this question of certainty in operation that requires careful attention, for it is the one thing at the present time that the aeroplane requires in order that it may take its proper place in commercial work. Engines for this will probably be more heavily built to reduce the possibility of breakdown, and multi-engine machines will be used which can fly satisfactorily even if one engine breaks down. Here again this points to the use of the larger machine.

Finally, it must be pointed out that the same improved performance can be obtained from a large machine, whether for scouting, fighting, or weight carrying, provided that the specifications are the same in both cases. It is absurd to compare the performance of a weight-carrying machine with high values of useful weight per H.P. with a small scout of very small useful weight per H.P., and particular attention is, therefore, drawn to the methods of comparison set out in Section II., so that careful comparison may result.

The Model H-12 Curtiss Flying Boat.

Curtiss Model Twin JN military tractor.

DISCUSSION.

Mr. F. W. Lanchester, chairman, in opening the discussion, said that he desired to congratulate Mr. Handley Page on his very able paper. It was perfectly true that some twelve months ago he had opposed the position forced upon aeroplane constructors by the popular clamour for the battleplane, comparable to the dreadnought, and the demand for the building of an enormous fleet of aeroplanes. For that reason he had been opposed to the large aeroplane. The present is the period of the small aeroplane. When the safety of the country depends on its armament it is rather important to go with due caution. He was heartily appreciative of the work of Mr. Handley Page, and he felt that he had the courage of his convictions. He believed the work of Mr. Page would stand as work of the greatest value to aeroplane development. On the question of the development of the engineering side especially there was room for controversy. Mr. Page said when the weight increased the structural weight did not increase proportionately. The big scale certainly altered the question when not working to the same drawings. As to whether it was more economical to build one large aeroplane or many small ones, that at present depended on the military outlook.

With regard to the various curves displayed by Mr. Page, Mr. Lanchester said everybody had his own system of curves, and thought that

Gallaudet twin motored seaplane constructed for the U. S. Navy.

THE SIMPLEX HISPANO-SUIZA MOTOR

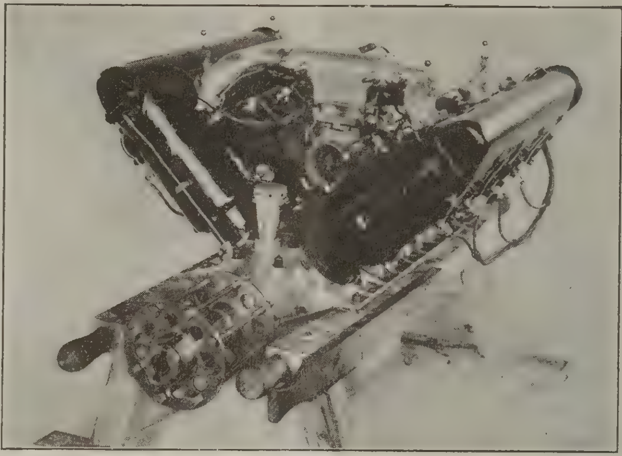
WE take pleasure in presenting this week two pictures of the Hispano-Suiza motor, constructed by the Wright-Martin Aircraft Corporation.

The motor shown is known as Model A, and develops 150 h.p. at 1450 r.p.m. It is of the water-cooled four-cycle Vee type, with eight cylinders, 4.7245 inch bore by 5.1182 inch stroke, piston displacement 718 cubic inches. At sea level it develops 150 h.p. at 1,450 r.p.m. It can be run successfully at much higher speeds, depending on propeller design and gearing, developing proportionately increased power. The weight, including carburetor, two magnetos, propeller hub, starting magneto and crank, but without radiator, water or oil or exhaust pipes, is 445 lbs. Average fuel consumption is .5 pound per horsepower hour and the oil consumption at 1,450 r.p.m. is three quarts per hour.

Four cylinders are contained in each block, which is of built-up construction; the water jackets and valve ports are cast aluminum and the individual cylinders heat-treated steel forgings threaded into the bored holes of the aluminum castings. Each block after assembly is given a number of protective coats of enamel, both inside and out, baked on. Coats on the inside are applied under pressure.

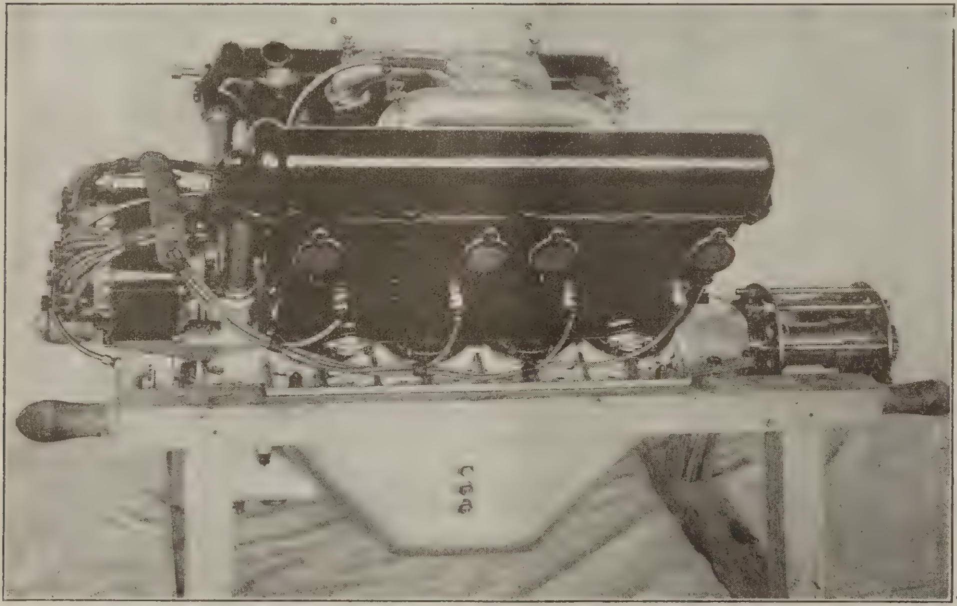
The crankshaft is of the five-bearing type, very short, stiff in design, bored for lightness and for the oiling system. The crankshaft extension is tapered for the French standard propeller hub, which is keyed and locked to the shaft. This makes possible instant change of propellers. The case is in two halves divided on the center line of the crankshaft, the bearings being fitted between the upper and lower sections. The lower half is deep, providing a large oil reservoir and stiffening the engine. The upper half is simple and provides magneto supports on extension ledges of the two main faces.

The valves are of large diameter with hollow stems, working in cast iron bushings. They are directly operated by a single hollow camshaft located over the valves. The camshafts are driven from the crankshaft by vertical shafts and bevel gears. The camshafts, cams and heads of the valve stems are all enclosed in oil-tight removable housings of cast aluminum.



Hispano-Suiza Model A

Oiling is by a positive pressure system. The oil is taken through a filter and steel tubes cast in the case to main bearings, through crankshaft to crank pins. The fourth main bearing is also provided with an oil lead from the system and through tubes running up the end of each cylinder block, oil is provided for the camshafts, cams and bearings. The surplus oil escapes through the end of the camshaft where the driving gears are mounted, and with the oil that has gathered in the top casing, descends through the drive shaft, and gears to the sump.



Hispano-Suiza Model A

(*Continued from page* 109)

everybody else ought to agree with him. He doubted whether all those present understood and agreed with the said curves.

Wing-Commander C. J. L'Estrange Malone, R.N., stated that as regards the limiting size of aeroplanes some thousands of years ago men probably argued as to whether a ship could be bigger than one man could dig out of a tree with a penknife, and the present position seemed to him somewhat analogous. He thought engineers must abolish limitations of size by introducing new materials into aeroplane construction.

Lieutenant Archibald R. Low, R.N.V.R., at the request of Commander Malone, then illustrated by lantern slides a method of calculation evolved a few years ago by a French aeronautical engineer relative to the limiting size of aeroplanes. He stated that he considered Mr. Page an "outrageous heretic," as structural weight must necessarily increase faster than the size of an aeroplane. If it did not increase actually as the cube of the dimensions, a limiting size would still be reached.

Mr. Leonard Bairstow, A.R.C.S., in the course of his remarks, during which he challenged Mr. Page's conclusions, stated that there are limitations, and there will come a time when the size of the machine increases in which you will not be able to increase the load; the load will increase more rapidly than the weight.

Captain F. S. Barnwell, R.F.C., referred to the ability of improving the structure. As large machines cannot be "chucked" about by the pilot they do not need the same factor of safety; the smaller the machine the higher the factor of safety. All theoretical curves were based on model figures for small wings at low speeds, and therefore could not be applied to larger machines. If one worked on very small model figures one went wrong on higher speeds. At present the aeroplane was purely a war machine, and the most important quality for a war machine was maneuver ability, so that for the time being the large machine was out of court. The best fighting machines were composed of the largest and lightest possible engine with the smallest possible fringe of aeroplane round it. He had a personal liking for the smallest aeroplane round the best engine.

Mr. G. Holt Thomas said that he disagreed with Mr. Page on sundry points. The large aeroplane was for the sea, where it would have unlimited space, but for military purposes he thought when carrying large loads over the land it would be better to split it up and carry it on small machines.

Mr. R. L. Howard Flanders said that when the weight per horse power of a machine was increased, the climb seemed to fall off disproportionately.

Wing Commander A. M. Longmore, R.N., said that there was plenty of room for all types, and that aeroplanes, like ships, could be classed as destroyers (scouts,) light cruisers (1½ strutters), cruisers (ordinary two-seaters) and battleships (big aeroplanes). As in warships, the armament must go up correspondingly with the big machine. Otherwise it has the same armament as the small machine. A few extra machine guns with the same range as those carried by "destroyers" were not enough. The present type of big machine with the engines and tanks spread out added, he thought, to the vulnerability of the machine. There seemed no reason why the power plant should not be centralised and well-armoured.

METHODS OF MEASURING AIRCRAFT PERFORMANCES*

By CAPT. H. T. TIZARD, R. F. C.

AEROPLANE TESTING

THE accurate testing of aeroplanes is one of the many branches of aeronautics which have been greatly developed during the war, and especially during the last year. For some months after the war began a climb to 3,000 to 5,000 ft. by aneroid and a run over a speed course was considered quite a sufficient test of a new aeroplane; now we all realize that for military reasons certainly, and probably for commercial reasons in the future, it is the performance of a machine at far greater heights with which we are mainly concerned. In this paper I propose to give a short general account of some of the methods of testing now in use at the Testing Squadron of the Royal Flying Corps, and to indicate the way in which results of actual tests may be reduced, so as to represent as accurately as possible the performance of a machine independently of abnormal weather conditions, and of the time of the year. For obvious reasons full details of the tests and methods employed cannot yet be given. So far as England is concerned, I believe that the general principles of what may be called the scientific testing of aeroplanes were first laid down at the Royal Aircraft Factory. Our methods of reduction were based on theirs to a considerable extent, with modifications that were agreed upon between us; they have been still further modified since, and recently a joint discussion of the points at issue has led to the naval and military tests being co-ordinated, so that all official tests are now reduced to the same standard. It should be emphasized that once the methods are thought out scientific testing does not really demand any high degree of scientific knowledge; in the end the accuracy of the results really depends upon the flyer, who must be prepared to exercise a care and patience unnecessary in ordinary flying. Get careful flyers whose judgment and reliability you can trust and your task is comparatively easy; get careless flyers and it is impossible.

At the outset it may be useful to point out by an example the nature of the problems that arise in aeroplane testing. Suppose that it is desired to find out which of two wing sections is most suitable for a given aeroplane. The aeroplane is tested with one set of wings, which are then replaced by the other set, and the tests repeated some days later. The results might be expressed thus:—

	A Wings.	B Wings.
Speed at 10,000 ft.	90 m.p.h.	93 m.p.h.
Rate of climb at 10,000 ft.	250 ft. a minute.	300 ft. a minute.

Now, the intelligent designer knows, or soon will know, that, firstly, an aneroid may indicate extremely misleading "heights"; and, secondly, that even if the actual height above the ground is the same in the two tests, the actual conditions of atmospheric pressure and temperature may have been very different on the two days. He will therefore say, What does that 10,000 mean? Do you mean that your aneroid read 10,000 ft., or do you mean 10,000 ft. above the spot you started from, or 10,000 ft. above sea-level? If he proceeds to think a trifle further he will say, What was the *density* of the atmosphere at your 10,000 ft.; was it the *same* in the two tests? If not, the results do not convey much. There he will touch the keynote of the whole problem, for it is on the density of the atmosphere that the whole performance of an aeroplane depends; the power of the engine and the efficiency of the machine depends essentially on the density, the resistance to the motion of the machine through the air is proportional to the density, and so finally is the lift on the wings. None of these properties are proportional solely to the pressure of the atmosphere, but to the density—that is, the weight of air actually present in unit volume. It follows that it is essential when comparing the performances of machines to compare them as far as possible under the same conditions of atmospheric *density*, not as is loosely done at the same height above the earth, since the density of the atmosphere at the same height above the earth may vary considerably on different days, and on the same day at different places.

At the same time, in expressing the final results, this principle may be carried too far. Thus, if the speed of a machine were expressed as 40 metres a second at a density of 0.8 kilogs. per cubic metre, the statement, though it may be strictly and scientifically accurate, will convey nothing to 99 per cent. of those directly concerned with the results of the test. The result is rendered intelligible and, indeed, useful by the form "90 m.p.h. at 10,000 ft.," or whatever it is. With this form of statement, in order that all the statements of results may be consistent and comparative, we must be careful to mean by "10,000 ft." a certain definite density—in fact, the average density of the atmosphere at a height of 10,000 ft. above mean sea-level. This is what the problem of "reduction" of tests boils down to: what is the relation between atmospheric density and height above sea-level? This knowledge is obtained from meteorological observations. We have collected all the available data, mostly unpublished, with results shown in the following table:—

TABLE I.—*Mean Atmospheric Pressure, Temperature and Density at various Heights above Sea-Level.*

Height in Kiloms.	Height in equivalent feet.	Mean pressure in millibars.	Mean temp. in absolute degrees Centrigrade.	Mean density in kgm. per cubic metre.
0	0	1,014	282	1.253
1	3,280	900	278	1.128
2	6,560	795	273	1.014
3	9,840	699	268	0.909
4	13,120	615	262	0.818
5	16,400	568	255	0.735
6	19,680	469	248	0.658
7	22,960	407	241	0.589

These are the mean results of a long series of actual observations made mainly by Dr. J. S. Dines. It is convenient to choose some density as standard, call it unity, and refer to all other densities as fractions or percentages of this "standard density." We have taken, in conformity with the R.A.F., the density of dry air at 760 mm. pressure and 16° C. as our *standard density;* it is 1.221 kilog. per cubic metre. The reason this standard has been taken is that the air speed indicators in use are so constructed as to read correctly at this density, assuring the law: $p = \frac{1}{2}\rho V^2$, where V is the air speed, p the pressure obtained, ρ the standard density.

In some ways it would doubtless be more convenient to take the average density at sea-level as the standard density, but it does not really matter what you take so long as you make your units quite clear. Translated into feet, and fraction of the standard density, the above table becomes:—

TABLE II.

Height in feet.	Percentage of standard density.	Height in feet.	Percentage of standard density.	Height in feet.	Percentage of standard density.
0	102.6	7,000	81.9	15,000	63.0
1,000	99.4	8,000	79.2	16,000	61.1
2,000	96.3	9,000	76.5	†16,500	60.1
3,000	93.2	†10,000	74.0	17,000	59.1
4,000	90.3	11,000	71.7	18,000	57.1
5,000	87.4	12,000	69.5	19,000	55.2
6,000	84.6	†13,000	67.3	20,000	53.3
†6,500	83.3	14,000	65.2		

Let us briefly consider what these figures mean. For example, we say that the density at 10,000 ft. is 74 per cent. of our standard density, but it is not meant that at 10,000 ft. above mean sea level the atmospheric density will always be 74 per cent. of the standard density. Unfortunately for aeroplane tests this is far from true. The atmospheric density at any particular height may vary considerably from season to season, from day to day, and even from hour to hour; what we do mean is that if the density at 10,000 ft. could be measured every day, then the *average* of the results would be, as closely as we can tell at present, 74 per cent. of the standard density.

The above table may therefore be taken to represent the conditions prevailing in a "normal" or "standard" atmosphere, and we endeavor, in order to obtain a strict basis of comparison, to reduce all observed aeroplane performances to this standard atmosphere, *i.e.,* to express the final results as the performance which may be expected of the aeroplane on a day on which the atmospheric density at every point is equal to the average density at the point. Some days the aeroplane may put up a better perfomance, some days a worse, but on the average, if the engine power and other characteristics of the aeroplane remain the same, its performance will be that given.

It must be remembered that a standard atmosphere is a very abnormal occurrence; besides changes in density there may occur up-and-down air currents which exaggerate or diminish the performance of an aeroplane, and which must be taken carefully into account. They show themselves in an otherwise unaccountable increase or decrease in rate of climb or in full speed flying level at a particular height.

We now pass to the actual tests, beginning with a description of the observations which have to be made and thereafter to the instruments necessary. The tests resolve themselves mainly into (*a*) A climbing test at the maximum rate of climb for the machine. (*b*) Speed tests at various heights from the "ground" or some other agreed low level upwards.

Experience agrees with theory in showing that the best climb is obtained by keeping that which is frequently called the air speed of an aeroplane, viz., the indications of the ordinary air speed indicator, nearly constant whatever the height—in other words, ρV^2 is kept constant. We can look at this in this way. There is a limiting height for every aeroplane above which it cannot climb; at this limiting height, called the ceiling of the machine, there is only one speed at which the aeroplane will fly level, at any other air speed higher or lower it will descend. Suppose this speed be 55 m.p.h. on the air speed indicator. Then the best rate of climb from the ground is obtained by keeping the speed of the machine to a steady indicated 55 m.p.h. Fortunately a variation in the speed does not make very much difference to the rate of climb; for instance, a B.E.2c with a maximum rate of climb at 53 m.p.h. climbs just as fast up, say, 5,000 ft. at about 58 m.p.h. This is fortunate as it requires considerable concentration to keep climbing at a steady air speed, especially with a light scout machine; if the air is at all "bumpy" it is impossible. At great heights the air is usually very steady, and it is much easier to keep to one air speed. It is often difficult to judge the best climbing speed of a new machine; flyers differ very much on this point, as on most. The Testing Squadron, therefore, introduced some time ago a rate of climb indicator intended to show the pilot when he is climbing at the maximum rate. It consists of a thermos flask, communicating with the outer air through a thermometer tube leak. A liquid pressure gauge of small bore indicates the difference of pressure between the inside and outside of the vessel. Now, when climbing, the atmospheric pressure is diminishing steadily; the pressure inside the thermos flask tends therefore to become greater than the outside atmospheric pressure. It goes on increasing until air is being forced out through the thermometer tubing at such a rate that the rate of change of pressure inside the flask is equal to the rate of change of atmospheric pressure due to climbing. When climbing at a maximum rate, therefore, the pressure inside the thermos flask is a maximum. The pilot therefore varies his air speed until the liquid in the gauge is as high as possible, and this is the best climbing speed for the machine.

What observations during the test are necessary in order that the results may be reduced to the standard atmosphere? Firstly, we want

(*Continued on page* 117)

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[*] *Paper read before the Aeronautical Society of Great Britain on March 7th.*

[†] *6,500 ft. is introduced as corresponding roughly to the French test height of 2,000 metres. 10,00 ft. similarly corresponds roughly to comparing aeroplane test performances to the French standard of 3,000 metres, and similarly for 13,000 and 16,500 ft.*

THE 200 H. P. MAYBACH ENGINE

In several recent issues of the Automobile Engineer there have been presented parts pertaining to German aero engine development which are particularly interesting at this time. There is little doubt that the information set forth, while being of considerable interest to the majority of our readers, will be particularly so to such as are engaged upon, or associated with, aircraft engine production.

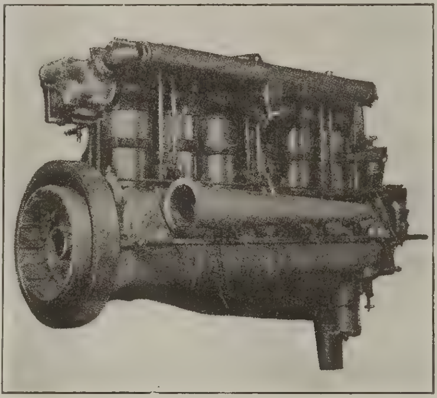
Our first, and present, description is of the Maybach engine, as fitted to the Schutte Lanz and Zeppelin airships. This engine is probably of the latest Maybach design, and presents many interesting features, although main interest really centres around the parts that are more in the nature of accessory fittings, made necessary or advisable by the particular application of the engine, viz., airship propulsion. Before proceeding to describe the engine and its accessories in detail, a general outline of the function and layout of the more unusual fittings will doubtless be of interest.

Instead of regarding each portion of the engine accessory system as a separate item, it will probably be simpler to regard each fitting as a separate item in reviewing its purpose in the general layout, and also to confine our attention at the moment to those parts not usually found on an aircraft engine.

Referring to the general diagram of the oil and gasoline pressure system (fig. 1), it will be seen that in the top left-hand corner there are two pumps driven by a common crank that is attached to a shaft, this shaft being worm gear driven off the engine crank. The horizontal pump is that for the fuel, and it will be noticed that the valves of this pump are far removed from the pump itself, being located at the base of the chamber seen at the bottom left-hand corner of the general diagram. The reason for this arrangement is the practical impossibility of pumping liquid petrol, so that a column of air has been interposed between the pump and the petrol itself. It will be noticed that the fitting containing the petrol pump valves also carries the oil filter, of course, definitely divided off, but incorporated in the body of the same fitting. The reason for this is most probably that it happened to be convenient to embody the two in one. There does not seem to be very much reason to suppose that the two are combined with a view to warming the petrol and alternately cooling the oil. Its position on the engine is denoted by the letter A in the general arrangement diagram of the engine (fig. 2).

The fitting shown at the right-hand bottom corner of fig. 1 is really merely the float chamber of the carbureter. It functions somewhat differently, as it is arranged to operate at varying altitudes, but in effect it serves the purpose of a float chamber to feed the carbureter reservoir. Its position relative to the engine is shown at B in fig. 2, and it has probably been located in the position shown from motives of safety, as evidently, in the position shown in the general diagram, danger arising from a float chamber near to the engine is avoided.

With reference to the oil system, this is made clear in a detailed description following, and calls for no special note at this point, except as regards the control that the oil pressure exercises over the fuel supply. This control is clearly shown to the right in the diagram (fig. 1), where connection will be seen between the jet damper and an oil controlled vertical piston. This piston is under oil pressure, and serves merely to hold out of action a stop that controls the jet cut-off, so that as long as the oil pressure maintains the fuel supply continues. When the oil pressure drops below a predetermined limit, the piston rises under the influence of its spring, releasing a catch and so closing the jet. Oil to this fuel controlling piston is distributed through a centrifugally-governed piston valve that is adjustable externally, the oil being throttled by means of an adjusting lever that limits the travel of the piston valve, so that by the setting of the lever, the actual oil pressure in the lubricating system is determined. This explanation does not quite coincide with the positions assigned to the oil piston valves and ports in another diagram, but the present diagram (fig. 1) gives a satisfactory explanation of the principle of the control. Evidently the piston controlling the fuel cut-out stop can, by so arranging the strength of its spring, be given a certain range of action; that is to say, it can be designed to maintain its position and hold off the fuel stop between any range of oil pressure required, say, from 5 lb. minimum to 35 lb. maximum, according to the strength of the spring, which merely needs to be strong enough to overcome the minimum pressure decided upon, as it is not until oil pressure drops that there is any necessity for cutting off the fuel.



The 200 H. P. Maybach

The carbureter, which is shown in the top right-hand corner of the diagram (fig. 1), needs no general explanation at this stage, and will be described in full detail later. The small oil radiator, together with the system of filters beneath it, are simply the oil cooling and filtering circuit, and, as a matter of fact, it is believed that these were, by a curious whim of the chief engineer, generally cut right out of service when the airships were in use.

The engine starting mechanism consisted of a pump and the necessary mechanism for filling the cylinders with mixture, which was ignited by a geared-up hand starter. Fuller details of this system are given in the following pages.

With regard to details of the engine itself, the bore is 150 mm., the stroke 190 mm., and the compression ratio 5.94 to 1; the normal b.h.p. is estimated as 200 at 1,200 r.p.m. Each of the six cylinders is a separate unit, consisting of a steel cylinder, screwed into a malleable cast iron head and jacket casting, containing the valve seatings. The cylinder barrel is provided with a rectangular groove about half-way down, into which is fitted the packing material forming the water-jacket joint. The material used in making the water joints is probably asbestos, clamped into position by several turns of copper wire, wound round the cylinder barrel inside the machined groove. A variation of this joint is evidently in use, as on a cylinder carried on the Zeppelin as a spare a large union nut was employed at the flange, and a plain joint used in the cylinder head. The cylinder barrel is hardened at its base, or holding-down flange, presumably for the purpose of strengthening it.

Five valves per cylinder are arranged, the two inlet ports being 48 mm. diameter and the exhaust ports 35 mm. diameter. The exhaust valves are situated on the left-hand side of the engine looking from the flywheel and propeller end, and all the valves are of the overhead type, working vertically in the water-cooled cylinder head, and operated by rocker arms. All the three valve rocker arms for the exhaust valves are in one stamping, and are operated by one push rod. Similar construction and actuation are adopted for the inlets, the push rod ends being cupped, and the rockers and tappets arranged with spherical heads to correspond. The rocker arms are on hollow spindles supported on brackets bolted to the cylinder heads. No adjustment is provided other than the adjusting screw on each valve rocker arm.

The valve gear is operated by two camshafts, one on either side of the crankshaft. There are driven by gears inside the crank case at the flywheel end. Cam rollers are fitted to the tappets in the usual manner.

The large circular water joint between each of the six cylinders is made by a 6½-in. diameter rubber and wire ring about ½-in. thick, encircled by a hand clip of sheet brass. This clip, when screwed up, reduces the diameter of the packing ring, causing the rubber to expand, thus making a simple face joint against the two machined faces of the water jacket. Water cooling is by a pump working vertically inside the water lead to the front cylinder in an extension of the crank case casting. The pump spindle with vane shown in fig. 3, is driven directly off the crankshaft bevel gear at twice the speed of the engine; its position is shown at C in fig. 2.

The diameter of the water inlet pipe leading from the radiator to the crank case extension is

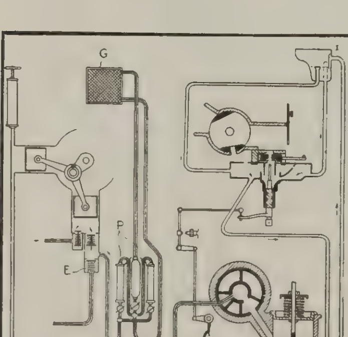


Fig. 1

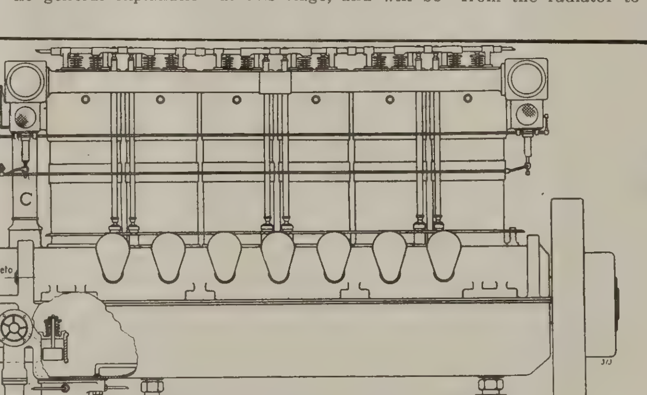


Fig. 2.
General disposition of accessories on or relative to the engine. Diagram only, not necessarily to scale or accurate in detail.

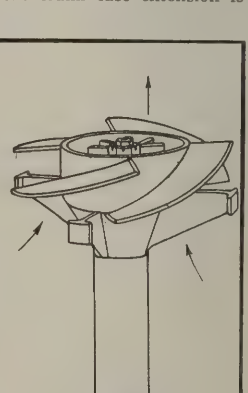
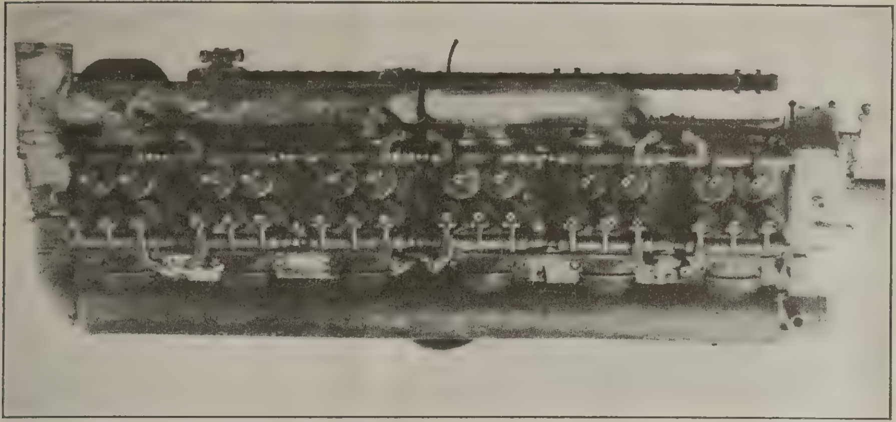


Fig. 3.



Top View of Maybach Engine

2¼ inches. Water from the pump enters the aluminum water jacket surrounding the front carbureter, which is attached to the 6½-in. water joint flange of the front cylinder, and thence the water flows through all the cylinder jackets and, circling the water jacket of the other carbureter attached to the flange of the rear cylinder, enters the copper water jacket surrounding the exhaust manifold, whence a return pipe leads back to the radiator. The crank case is internally scavenged and cooled by inducing a current of air, as shown in fig. 4. A marine-type cowl that projects throug the roof of the gondola leads direct to a large aluminium pipe, tapering in diameter, arranged externally beside the crank case and communicating with it by six short branches.

Attached to the crank case in a similar position on the opposite side are six breathers, or gauze-covered ventilators, that stand vertically and flat against the crank case. The arrangement of this breathing or scavenging is as shown in fig. 4, but it should be noted that the cowl opening is towards the rear of the ship, so that scavenging takes place by suction induced by the ship's motion.

The cylinder holding-down bolts are pegged into the crank case casting at the top, and are provided with flanges, so that the bearing caps are not disturbed when the cylinders are removed, as the holding-down bolts pass right through the crank case top half in the usual manner. Each cylinder is held down by four clamps or dogs.

With regard to lubrication, oil is drawn by the vertical oil pump (figs. 1 and 5) from the oil service tank D (fig. 2), situated below the crank chamber, through the check valves directly below the pump piston by a pipe leading to the two vertical filters P, whence the oil is led into the top of the small oil cooler or radiator G (fig. 1). This cooler is situated outside the gondola.

After passing through the cooler, the oil returns through the main oil filter K to the main bearings. The main bearings can also be lubricated direct from the pressure pump, cutting out the oil cooling system by the cocks below the filters P.

The surplus oil returns to the service tank through the relief pressure valve E.

All the valve rockers are lubricated under pressure through hollow spindles coupled together between the cylinders by rubber connections and clips. The oil enters at one end of the rocker arms through a pipe leading from the main oil supply, and passes through the hollow spindles of the inlet rocker arms, and returns along the exhaust valve rocker spindles to the base chamber. The oil in the crank case returns to the service tank by two large drain passages leading directly from the bottom of the crank chamber into the service tank below.

The six-throw crankshaft runs on seven plain bearings, the diameter of the journals and the crank pins being 66 mm. The journals are bored with a 40 mm. hole, and the crank pin with a 36 mm. hole, the ends of the latter being plugged by aluminium oil catcher troughs clamped together by a 7 mm. bolt through the hollow crank pin. The weight of the complete crankshaft with camshaft driving pinion and bevel gear for driving the water pump, etc., is about 99 lb.

The pistons are of cast iron, fitted with three rings above the gudgeon pin, each piston weighing, complete with gudgeon pin and rings, 10.84 lb. The gudgeon pin is 38 mm. diameter, and is located by a set screw, screwed vertically into the pin from the bottom of the gudgeon pin boss inside the piston and locked with a split pin inside the hollow gudgeon pin.

The connecting rods are square section externally, 33 mm. each way, and are bored up the centre with a 26 mm. hole, through the centre of which an 11 mm. pipe is fixed, leading from the big end bearing to the gudgeon pin bush for lubricating the small end.

Each engine is fitted with two separate carbureters, situated at either end of the engine itself. They are attached to the water jackets of the end cylinders by the water jacket flanges. A sketch arrangement of the carbureters showing the position of the jet, throttle valve, and constant head jet reservoir, and also the water jackets, is shown in fig. 6.

The large cylindrical wire gauze baffle adjacent to the carbureter, and at the end of the induction pipe shown in the sketch, is presumably to stop firing back into the carbureter. It might also further break up the mixture.

A detailed account of the working of the carbureter, with its unusual system of fuel supply, will doubtless be of interest, and in fig. 7 is given a diagram of the carbureter, that has been prepared to show the observed interior construction. The carbureter consists of the following parts: A barrel throttle, a main air regulator, a jet, and damping device, and a constant head gravity gasoline feed reservoir.

The rotary barrel throttle opens on one side to the inlet pipe, on the other to a mixing chamber. In the lower portion of the barrel is a large extra air port registering with a port in the casing. The size of this port is further controlled by an air shutter (not shown).

The main air regulator is of the sliding shutter or guillotine type. It opens or shuts as the throttle opens or shuts, being interconnected by bell crank levers.

The jet has an eccentric hole covered by a cap, also with an eccentric hole, so that rotation of the cap regulates the area of the jet hole. The arrangement appears similar in action to the jet of the White and Poppe carbureter. The jet cap is also interconnected with the throttle and air slide, opening when they open, and *vice versa.*

The jet damping device is interconnected with the lubrication system, but might have been operated separately, if desired.

The constant head gravity petrol feed to the jet, in lieu of the usual and adjacent float feed, is provided by a small reservoir placed a little higher than the jet, that is fed from the float chamber, in turn fed from the pump and the separate air vessel or valve box.

It may be safely assumed that the operation of the carbureter, so far as carburation is concerned, is the same as in the White and Poppe; that is to say, the quality of the mixture is, at any throttle opening, kept constant by mechanical means, *i.e.*, the interconnection of the throttle air and jet orifices, as shown in fig. 9. Means of adjustment of the relative setting of these three are provided.

(To be continued)

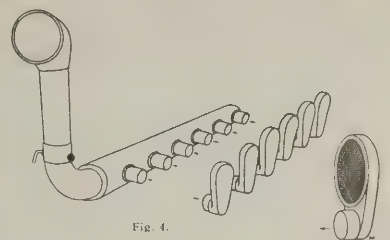


Fig. 4.

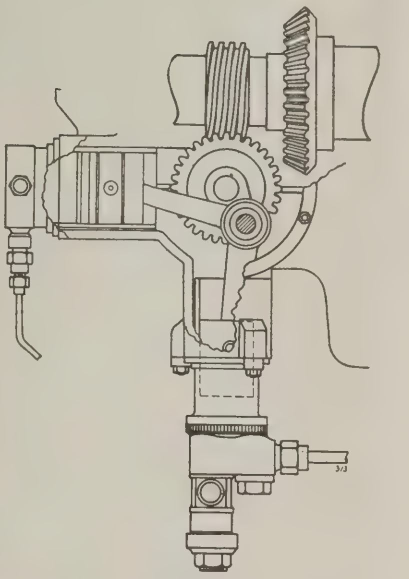


Fig. 5.

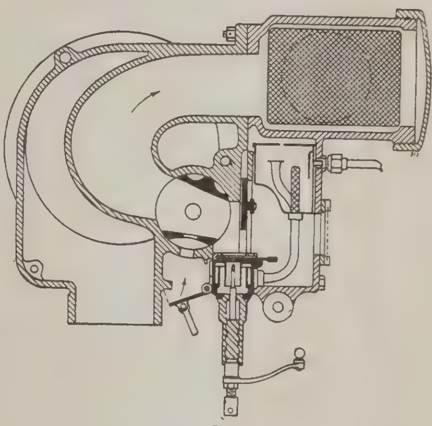


Fig. 6.

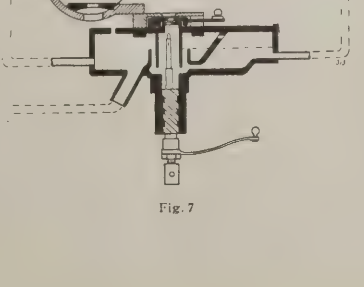


Fig. 7

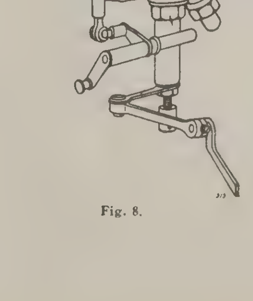


Fig. 8.

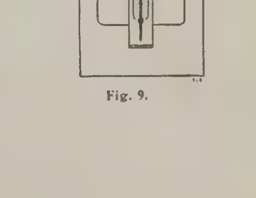


Fig. 9.

FOREIGN NEWS

BELGIUM.

King Albert of Belgium recently made a long airplane flight under fire over the fighting front, according to *La Metropole.* While visiting a new flying ground the King expressed a desire to act as an observation officer. Accordingly he ascended with the famous Belgian airman, Captain Jacquet, at 8:15 P. M. Preceded by a squadron of fighting planes the King flew over the whole Belgian-Yser front at a height of 3,000 to 6,000 feet. He made many observations and took photographs with success.

German anti-aircraft guns kept up a sustained fire, but no German airman ventured in the way of the King's aeroplane. Subsequently the King discussed his observations with the General Staff.

Henry E. Montgomery Suckley of Rhinebeck, N. Y., in charge of the Stock Exchange unit of the American Ambulance Field Service, was killed recently while on duty near Saloniki, according to a cable received by his uncle, H. E. Montgomery of 80 Broad street. The cable announcing his death came from General Sarrail, commanding the Allied troops at Saloniki, and was transmitted by Mr. Galatti, the second in command of the American Ambulance Field Service in Paris.

"Suckley," the General cabled, "was seriously wounded by an aeroplane bomb yesterday, and died this morning. He is proposed for the Legion of Honor."

Mr. Suckley was born in Orange, N. J., thirty years ago, and was a son of Robert B. Suckley of Rhinebeck, N. Y. Mr. Suckley graduated from Harvard in the class of 1910. He has served in the American Ambulance almost from the start of the war. After serving in the Vosges he was early in 1916 transferred to Pont-á-Mousson, and he was there until June of that year.

FRANCE

Miss Ruth Law, the American aviatrice who is in Paris studying the developments of aviation in France during the war, said to a correspondent for the European edition of the *Herald:*

"At Le Bourget I was simply astounded at the number of aeroplanes which have guarded Paris since the war and the different types of machines. If we combine all the aviation fields of America and call together all our aeroplanes, both military and privately owned, the display would not compare with that at Le Bourget, and, of course, there are many others in France.

"I came to France hoping to investigate the various makes of French aeroplanes and to buy the fastest machine made, but, of course, France is making no machines now except for military purposes, so I have no chance to determine which type of French machine I would prefer.

"I was very much surprised to find that the women of England have not taken up aviation to a greater extent. English women have always had the reputation of taking up all outdoor sports more seriously than American women, so I was disappointed to find few English women aviators."

Miss Law is coming home to take part in the race from San Francisco to New York in June, to be held under the auspices of the Aero Club of America. She says that her visit to England and France has been a great lesson to her and has given her many new ideas.

Lieutenant William Thaw, the American aviator, has won another citation in French army orders for a brilliant bit of work in the course of the German withdrawal from France. Thaw, while flying low on a reconnoitering expedition one day, discovered a large detachment of Germans who were protected by a screen of trees. They evidently formed the rear guard, left to cover the retreat of the main body.

Thaw swooped down and emptied his machine guns among the Germans at close range. Then he returned to his own lines and reported to the French cuirassiers, whom he directed to the German ambush, swooping down again to join in the attack.

Lieutenant Sweeney, another American who has won a commission in the French army, like his compatriots who are serving France has been eagerly studying the position of the United States with regard to the war. He tells the *New York Sun* correspondent that the French War Department, recognizing as natural the wish of American volunteers to serve with any American expeditionary force which may come to this country, has promised to release him within twenty-four hours if war between the United States and Germany is declared.

This is in line with the department's practice since the start of the European war. British volunteers were permitted to join the British expeditionary force, Belgians to join the Belgian army and Italians who were fighting under the younger Garibaldis to join the Italian army after Italy declared war.

The newspapers of Besancon say that German aeroplanes are dropping on French territory objects quite inoffensive in appearance, but which are in reality of the utmost deadliness.

Candy containing germs of epidemic diseases, fatal to any person eating it, and handbags and pocketbooks filled with dangerous explosives, which detonate on contact, have been cast down by German fliers, these newspapers declare.

GREAT BRITAIN

Of the many developments during the present war, nothing has equalled that of aviation. When the war began the various aviation services, by comparison with what they are now, amounted to little with respect to numbers of machines, numbers of aviators, the character of flights and the various uses to which these services are now put daily.

This rapid development is still going on. Greater than the fact that the aircraft now daily perform duties hardly thought of prior to the war is the one that any slackening in the development of the material used inevitably leads to falling behind the enemy.

The designers and builders must be constantly at work on improvements or the aviators at the front will soon find themselves in machines inferior to those of the enemy, and therefore unable to maintain the air superiority if they have it, or to obtain it if they have not.

The same evil will result if the number of machines, with, of course, the number of pilots and observers is not constantly increased.

At one time on the Somme the British maintained their air superiority with an inferior machine because they had sufficient numbers. A number of times in this war the air superiority has passed from one side to another because of the sudden appearance at the front of a superior type of machine.

In the beginning of the war the few aviators belonging to each army tried to perform in a general way the various duties assigned to them.

As the war progressed, and not only the value but the downright necessity for the continued use of aircraft became evident, it was soon seen that the service would have to be divided into various branches, depending upon the duty to be performed, and that these various duties demanded various types of machines, and frequently a variation in the training of some of the personnel manning them.

On land the duties at present may be divided into reconnoissance both in a war of movement, such as recently took place in Roumania or in a war of position such as that now going on along the French front; the observation of artillery fire both for ranging and combat; the preservation of the liaison between the infantry and the artillery during an attack: the preservation of the liaison between the general in comamnd of the unit and his troops in action; combat with other machines, with dirigibles; captive balloons and troops, and the attack on enemy depots and factories by raiding and dropping bombs on them.

Under normal conditions most, if not all of these various duties are being performed daily, not only in one part of the long lines on which the troops of the contending Powers face each other but on all parts.

The number of machines and pilots possessed by each Power is not, of course, published. However, it can be readily seen that the figure for any one great Power easily mounted into the thousands.

Aside from the nomal wear and tear, due to hard usage, there are the losses due to battle which have to be made good. During 1916, the English and French brought down about 900 German machines on the western front, to say nothing of eithy-one captive observation balloons.

The month of September, in which the fighting was heavy, saw the fall of 100 of these. When it is considered that, aside from these normal losses in material which have to be made good, the introduction of a new and better type of machine means the prompt replacement of a large part of the material, some idea can be gained of the tremendous construction which must go on.

As the power of aircraft increases the raids are carried further and further into enemy territory. This means that all important factories, depots and cities back of the zone of the armies must have aircraft defence.

While anti-aircraft guns can and do make such attacks difficult and dangerous, the only certain and real defence is a sufficient number of aircraft promptly to meet attack and drive back or defeat the invader.

Due to the fact that the weight of explosive which can by carried by any one machine is comparatively small and that a few hits, even though successful, produce little result, the number of machines sent on a raid is constantly increasing.

The number used for defensive purposes at the various points in danger of being raided must, therefore, also increase. The increase in the number of machines and the making good of casualties demands a considerable increase in the number of pilots and other personnel.

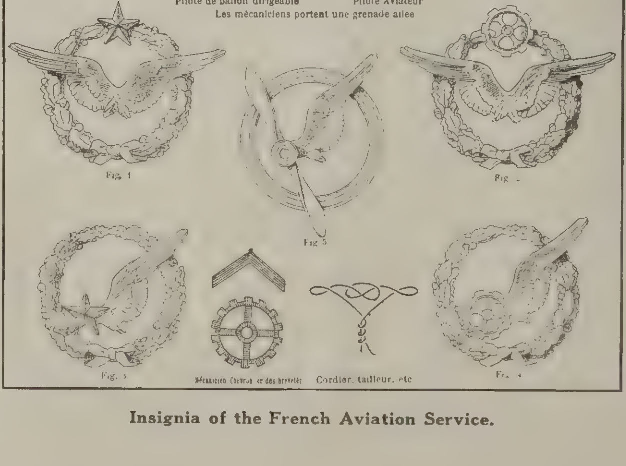
The various duties to be performed by the personnel require the establishment of schools in which the careful training necessary can be had. These schools, of course, must have machines, instructors, mechanics and other personnel.

From all this it is easily seen that, from being a minor auxiliary service, aviation has reached a point where it can be considered to be a separate branch of the service. There is every indication that a still more tremendous development will take place.

At the present time in the American army the aviation service, which has only few machines and a small number of pilots, is merely a branch of the Signal Corps, one of the auxiliary services of the army. To bring it up to the point of the French, British or German aviation service would require an immense increase in material and personnel.

Should we take their present status as the standard to be struggled for, we would find ourselves on reaching it still far behind, because these services are going to continue their development until the end of the war, and whatever point they will have reached at that time will merely be considered the starting point for their development in preparation for the next war.

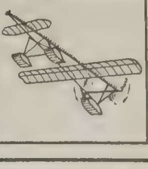
In other words, if we are to have an aviation service which will put us on a par with the great Powers, we should start immediately to build up a service which with respect to amount of material, number of personnel, and development of better types of machines is considerably in excess of anything now in existence.


Pilote de ballon dirigeable
Pilote Aviateur
Les mécaniciens portent une grenade ailee
Fig. 1
Fig.
Fig. 5
Fig. 3
Mécanicien Chevron or des brevetés
Cordier, tailleur, etc
Fig. 4

Insignia of the French Aviation Service.

MODEL NEWS

Edited by G. A. Cavanagh



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Model Gliders

A model glider represents the initial or elementary stage of model aviation just as a power-driven model represents the most advanced. A great deal can be learned from them, and they are and always will be worthy of careful study. It is said of the great Sir Isaac Newton that later on in life he regretted that he had not studied Euclid with that attention which so worthy a writer undoubtedly deserved. The story is that he had not studied him at all, but regarded his work to be of such an elementary character as to be self-evident. The moral of this story is obvious. If the greatest minds regret in later life a previous contempt for elementary things, how ill can the ordinary individual afford to neglect them with impunity. Of all the model gliders that we have experimented with we know none that surpasses the little Burge Webb glider. "In "Flying and Some of Its Mysteries," some eighteen or nineteen entirely distinct experiments are related that can be performed with it.

It may be as well to point out that a model glider is a very sensitive and delicate piece of apparatus indeed, and one which requires the most careful handling if good results are to be expected. The wings should never be handled if possible, but the machine carried, launched, and picked up by the backbone. Always be careful not to destroy or alter any crease or fold that the wing surface may possess. With fair treatment even a paper glider will last quite a long time, but we regret to have to say that most model gliders receive anything but fair treatment.

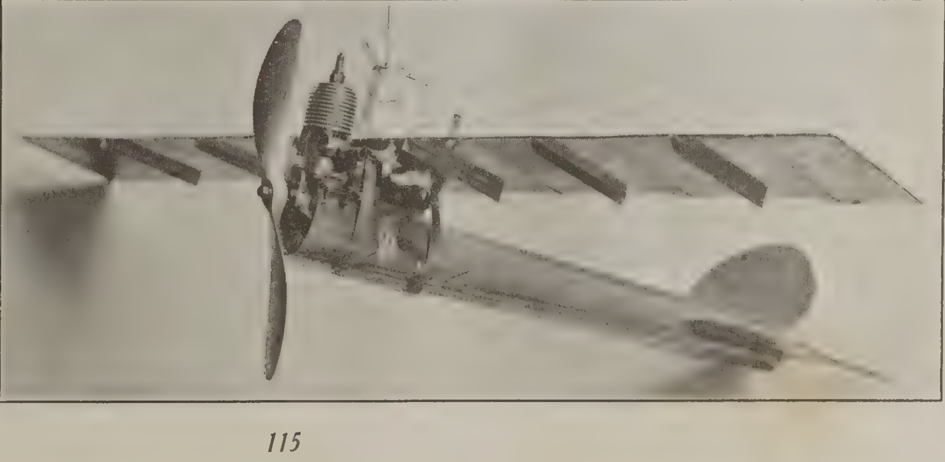
Another point in which due care must also be exercised is not to attempt to deduce too much re*stability in general,* from experiments made with such models in the (comparatively speaking) still air of a room. In the past dozens of patents and provisional specifications have been taken out on the sole strength of such experiments with the result that the patentees have, in by far the majority of cases, wasted both their time and money. Presuming, for the sake of argument, that you have, after a large number of experiments made with a small glider indoors, finally evolved a design which does seem worth something, the next step is to try it out of doors, on a considerably larger scale, *i.e.,* a minimum span of 4 ft. at least; at first in light breezes, and then in a high wind. Presuming it still successful, you would test it further by giving the model much longer flights, by suspending it from a kite some two or three hundred feet up and releasing it from the same. Again, presuming the result to be satisfactory, you would finally turn your glider—your (so-called) motorless aeroplane—into a motored one, *i.e.,* a model aeroplane carrying its own motor and propeller. The last test is an absolutely essential one; it is a natural conclusion to come to that if a model glider showing high stability glides well, it will also, when fitted with a motor and propeller, fly well and still show good stability. This by no means follows, however; so far as the loaded elevated-type of model is concerned, if it does not glide well when projected with its flight velocity, it is quite certain it will not be a successful flyer; but it does not of necessity follow that because it glides well (carrying, of course, its motor and propeller) it will also fly well. Though it would perhaps be fairly accurate to say that in the type alluded to it generally does so. In the tractor type of model it by no means follows that if the machine glides well it will also fly well—I have seen very many instances in which it did not do so. Nor is the converse true that if it flies well it will also glide well (to earth) when the propeller stops. Generally it does not do so—the aeroplane losing a certain proportion of its lift due to propeller blast—dives more or less steeply to earth. The reader must not conclude from this that a tractor model cannot be made to both fly and (if the handling be made against the breeze) also to glide to earth—because I have seen one model at any rate that does it—but it is a notable exception. I cannot agree with the correspondent in last week's issue that monoplanes make less satisfactory gliders than biplanes. It is quite a common thing for a paper glider to make several successful flights and then refuse to do any more. The explanation being that either one of the falls or improper handling has slightly altered its configuration, etc., and the conditions for a successful glide are no longer present. Naturally each particular glider has its own particular velocity at which it glides best.

Model Work in Tasmania

Doubtless many American model fliers will be glad to learn of the far reaching influence of the model aeroplane. This fact is clearly illustrated in the following letter from Mr. Clarence Arnott, Tasmania:

"I am a keen experimenter in aircraft, and have constructed and designed eight tractor machines, six being monoplanes and two biplanes, which have flown from 50 to 70 yards, hand launched, which is very good considering it is always blowing over here. The general public do not take any interest in models over here. They think because a few of us are interested in aviation that we are a bit *soft.* You will excuse this slang, but it is a fact. But we are going to show them what we really can do later on."

All steel model equipped with ½ H.P. gasoline engine, the product of the Weiss Mfg. Company. This model was exhibited at the Aero Show by the Buck Aircraft & Munitions Corp., and somewhat represents the large machine which they contemplate constructing in the very near future.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Diary of an Aviation Student

April 1st.

Went out to Mineola Flying field today with Ethel. Saw various pilots go through death-defying manoeuvers. Great admiration on the part of Ethel. If I wish to make her admire me, *must* learn to fly.

April 2nd.

Made application to aviation school and made out will.

April 3rd.

Parted with four hundred dollars for tuition, and promised thirty-one friends to take them aloft on my first flight. (Still, by the time I have learned to fly there will be aeroplanes capable of carrying that many people).

April 4th.

Went to store and purchased complete regalia for flying, and had pictures taken. Great mirth on part of cashier in photographer's.

April 5th.

Ethel pleaded with me not to risk my life. My chest swelled with determination, (while my heart quaked with fear), and I scoffed at her fears, saying that if I were killed, it would be a patriotic death, as our country needs aviators. Great admiration, and many tears on part of Ethel.

April 6th.

Went down to aviation field, to fly. Put to work in shop polishing wing struts. Made objection. Objection overruled. Stepped through a wing section and received bill for eighty-five dollars. Flying has lost some of its fascination.

April 7th.

Made flight! Confidentially must admit that I was paralized with terror. Came down, and was about to resign from school when Ethel approached, and said that although I looked pale, she could see strong determination in my face. Tried to look determined but succeeded only in looking surly.

April 8th.

Ethel brought automobile party down to see me fly. (That is, to see me taken aloft by the instructor). Great admiration on part of women, and disgust on part of men. Tried to look nonchalant but succeeded in looking cynical. While I was talking to girls, instructor comes up, and tells me to go into hangar and change the tires. Wanted to object but showed by face that I was humoring him. I hate the man! Got tires changed, and was about to go up when instructor changed his mind and took up some Japs. Spent balance of afternoon doping wings. Automobile party all left in disgust. No more so than I.

April 8th.

Pictures finished. Look like North Pole Explorer in aviation suit. Paid for pictures amid more mirth of cashier. Took pictures from pocket of Carlstrom landing from Chicago, and tried to look like Carlstrom. Mirth of cashier changed to unadulterated admiration.

April 9th.

Learned to say "Bus" instead of aeroplane. Practiced it for an hour to learn to say it unconsciously. Still feel rather foolish.

April 10th.

Made another flight. Took controls for landing. Had controls but not control. Consequence, badly damaged machine. Bill for nine hundred dollars. Refused to pay bill. Put in jail. Paid bill. Let out of jail. Resigned from Aviation School. Resignation accepted. Gave head instructor bawling out and left. (Rather precipitously.)

May 31st.

Received invitation to wedding. Ethel and Head Instructor. Going out to drown my sorrows.

June 4th

Seated at club. Not such a bad world after all!

Finis.

The Way News Travels

We vouch for the following, having heard it from a man lately returned from the front. It traces the report of the fall of Antwerp, starting in a French paper, Le Matin, and continuing through the columns of other papers.

Le Matin.

It is reported that when Antwerp was taken by the Germans, the church bells were rung in Berlin.

London Paper.

It is reported by our contemporary, Le Matin, that when Antwerp was taken by the Germans the citizens were forced to ring the cathedral bells in celebration.

Russian Paper.

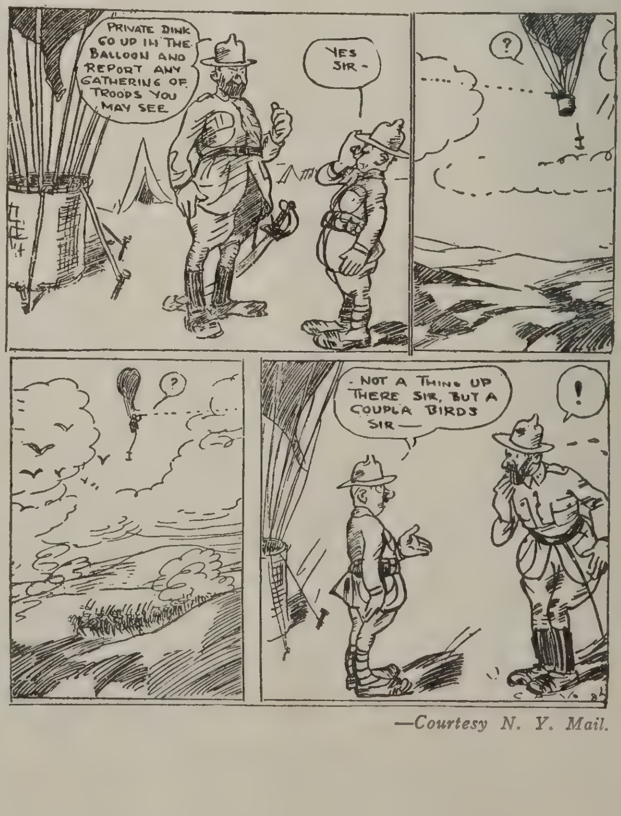
We hear from our London contemporary, ——— that when Antwerp fell the Belgian priests were forced to ring the church bells in celebration.

Spanish Paper.

According to the ————— of Petrograd, when the town of Antwerp was taken, the Belgian priests who refused to ring the church bells were deported to Germany.

Le Matin. (Three months later.)

We read in our Spanish contemporary, the —————, that when the Belgian priests refused to ring the church bells at the fall of Antwerp, they were lined up against the wall and shot!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(*Continued from page* 111)

the time from the start read at intervals, and the height reached noted at the same time. Here we encounter a difficulty at once, for there is no instrument which records height with accuracy. The aneroid is an old friend now of aeronauts as well as of mountaineers, but although it has often been tentatively exposed, it is doubtful whether 1 per cent. of those who use it daily realize how extraordinarily rare it is that it ever does what it is supposed to do, that is, indicate the correct height above the ground, or starting place. The faults of the aeroplane aneroid are partly unavoidable and partly due to those who first laid down the conditions of its manufacture. An aneroid is an instrument which in the first place measures only the *pressure* of the surrounding air. Now if p_1 and p_2 are the pressures at two points in the atmosphere, the difference of height between these points is given very closely by the relation, $h = \theta \log_e p^1/_{p2}$ where θ is the average temperature, expressed in "absolute" degrees, of the air between the two points. It is obvious that if we wish to graduate an aneroid in feet we must choose arbitrarily some value for θ. The temperature that was originally chosen for aeroplane aneroids was 50° F. or 10° C. An aneroid, as now graduated, will therefore only read the correct height in feet if the atmosphere has a uniform temperature of 50° F. from the ground upwards, and it will be the more inaccurate the greater the average temperature between the ground and the height reached differs from 50° F. Unfortunately 50° F. is much too high an average temperature; to take an extreme example, it is only on the hottest days in summer, and even then very rarely, that the average temperature between the ground and 20,000 ft. will be as high as 50° F. On these very rare occasions an aneroid will read approximately correctly at high altitudes; otherwise it will always read too high. In winter it may read on cold days 2,000 ft. too high at 16,000 ft., *i.e.*, it will indicate a height of 16,000 ft. when the real height is only 14,000 ft. It is always necessary therefore to "correct" the aneroid readings for temperature. The equation

$$H = \frac{273 + t}{283} \cdot h \; .$$

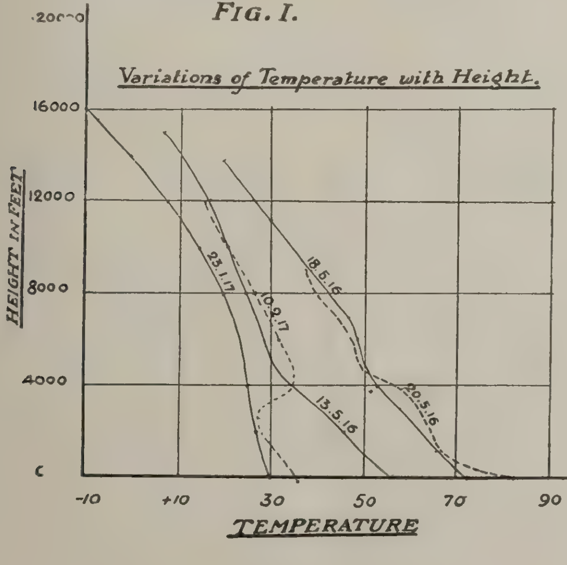
gives us the necessary correction. Here H is the true difference in height between any two points, t the average temperature in degrees Centrigrade between the points, and h the difference in height indicated by aneroid. It is convenient to draw a curve showing the necessary correction factors at different temperatures, some of which are given below:—

Table III.—*Aneroid Correction Factors.*

Temperature. °F.	Correction factor.	Temperature. °F.	Correction factor.
70	1.040	10	0.922
50	1.000	—10	0.833
30	0.961		

For example if a climb is made through 1,000 ft. by aneroid and the average temperature is 10° F., the actual distance in feet is only 1,000× 0.922=922 ft. The above equation is probably quite accurate enough for small differences of height—up to 1,000 ft. say—and approximately so for bigger differences. The magnitude of the correction which may be necessary shows how important it is that observations of temperature should be made during every test. For this purpose a special thermometer is attached to a strut of the machine, well away from the *fuselage*, and so clear of any warm air which may come from the engine. The French, I believe, do not measure temperature, but note the ground temperature at the start of a test, and assume a uniform fall of temperature with height. This, undoubtedly, may lead to serious errors. The change of temperature with height is usually very irregular, and only becomes fairly regular at heights well above 10,000 ft. This is shown by the following curves, which represent results taken at random from tests made at different times (Fig. 1).

FIG. I.



(*To be continued.*)

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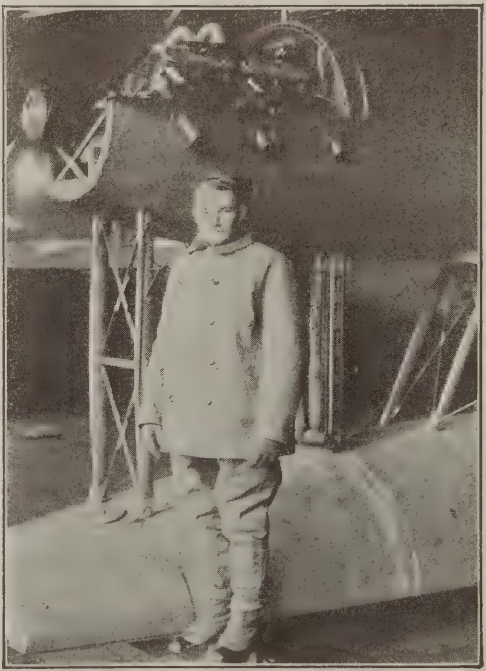

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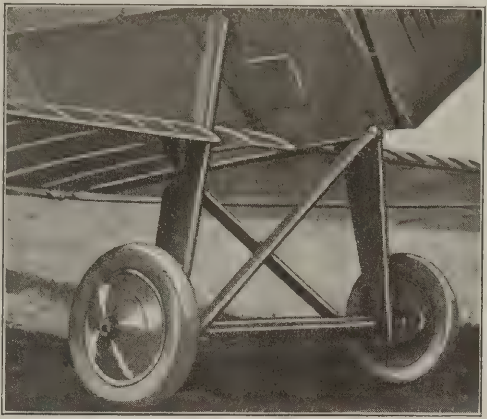

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Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of Aerial Age Weekly, published weekly, at New York, N. Y., for April 1, 1917, State of New York, County of New York. Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. Douglas Wardrop, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Aerial Age Weekly, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Aerial Age Co., Inc., 280 Madison Avenue, New York; Editor, G. Douglas Wardrop, 280 Madison Avenue, New York; Managing Editor, G. Douglas Wardrop, 280 Madison Avenue, New York; Business Manager, G. Douglas Wardrop, 280 Madison Avenue, New York; Assistant Business Manager, G. A. Cavanagh, 280 Madison Avenue, New York.

2. That the owners are: The Aerial Age Co., Inc., 280 Madison Avenue, New York; Henry Woodhouse, 297 Madison Avenue, New York; G. Douglas Wardrop, 280 Madison Avenue, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stocks, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only).

G. DOUGLAS WARDROP,
Business Manager.

Sworn to and subscribed before me this 27th day of March, 1917.

[Seal] DANIEL F. NUGENT, Notary Public.
Queens Co. 907. Certificate filed in N. Y. Co. 67. (My commission expires March 30th, 1917.)

Summer Meeting of Society of Automobile Engineers Notice Withheld Owing to Threatening International Conditions

The Society of Automobile Engineers, whose name will be changed next month to Society of Automotive Engineers, has been arranging for the most elaborate summer meeting in its history, including events and presentation of technical matter connected with aircraft, watercraft, and farm tractors, as well as motor cars. The various committees, including the Meetings Committee of which David Beecroft is chairman, and the Papers' Committee, which is conducted by H. G. McComb, have well advanced plans which can be put into final effect quickly as soon as it shall be known whether it will be possible or advisable to hold sessions of the scope intended. Meantime announcement of the time and place of the meeting is being withheld pending development of international conditions, with the thought that in the event of untoward results in this respect the society shall be as untrammeled as possible with plans interfering in any way with direct work for the Nation.

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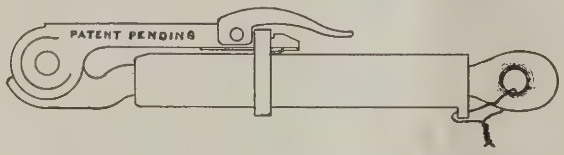

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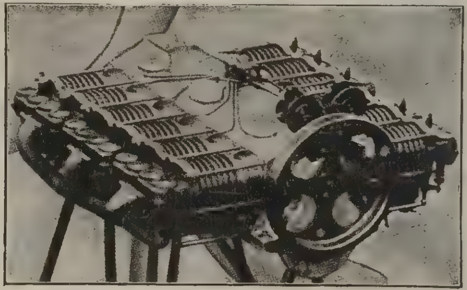

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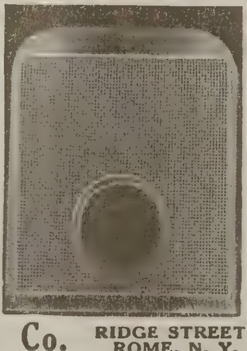

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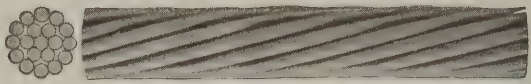
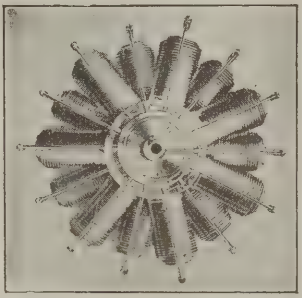


ROEBLING WIRE

Roebling 19 Wire Strand
Strand and Cord for
AEROPLANES
and Other Aircraft
THIMBLES AND FERRULES
Write for Information

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J., U. S. A.



GNOME & ANZANI

Motors
A
SPECIALTY

G.J. KLUYSKENS
112 W. 42d St., New York

BENOIST

Cross-Country planes and flying-boats have six years' actual building experience back of them.

Four Standard Models. Single and Twin motored three to seven passenger machines.

On application by interested parties, we will submit specifications on triple and four motored machines carrying as many as twenty passengers, and guarantee performance.

Benoist Aeroplane Company
SANDUSKY, OHIO

THE TURNER AVIAPHONE

Used by the Russian Government

Makes conversation possible between pilot and passenger.

Invaluable for military use because the officer can direct the pilot in scouting.

Indispensable when maps or photographs are to be made, because both hands are left free.

Mouthpiece in position only during conversation.

Light and Convenient

Outfit consists of 2 Head Caps, 2 Receivers for each user, light-weight Battery and Cords. Weight complete, 5 lbs. 5 ozs. Receivers Adjustable to any type of headgear.

Write Us To-day

GENERAL ACOUSTIC CO., 220 WEST 42d ST. NEW YORK

FOR SALE

Two military tractor biplanes, in excellent condition, can be seen in hangar convenient to New York City. One machine equipped with Curtiss 90 H.P. motor. Other machine minus motor, but fitted for Curtiss 100 H.P. For further details, write

BOX 139,
AERIAL AGE.

NATIONAL TURNBUCKLES
IMMEDIATE DELIVERY
NATIONAL AERO VARNISH, $3.75 PER GAL.
FOR AEROPLANE SURFACES
NATIONAL AEROPLANE COMPANY
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and MOTORS
New York Office: Times Building, Telephone Bryant 6147

Williams Aviation School

Dual Dep Control Tractors.
Tuition and Expenses Low.

WILLIAMS AEROPLANE CO.
FENTON, MICH.

Maximotor
In a Class By Itself
BUILT RIGHT AT THE RIGHT PRICE
Particulars Upon Request
Maximotor Company 1526 E. Jefferson Ave. DETROIT, MICH.

EFFICIENT TURNBUCKLES

Light, Durable and Offering Least Resistance. Hollow Bronze and Steel Barrels. Threads ever free from dirt
PRICES LOW :: DELIVERIES PROMPT
ALSO FULL LINE OF AERONAUTICAL SUPPLIES
Catalogue sent upon receipt of 10 cents
AERO MFG. & ACCESSORIES CO.
18 & 20 Dunham Place - - Brooklyn, N. Y.

Classified Advertising

Advertising in this department 10c. a word $2.50 minimum

Forms close for this department on Monday preceding date of issue

WANTED: SEVERAL FIRST CLASS draftsmen with aeroplane experience. Also woodworkers and aeroplane assemblers. Thomas-Morse Aircraft Corporation, Ithaca, New York.

WANTED A THREE-CYLINDER ANZANI motor. State price and condition. Art Roza, 1517 So. Harding Avenue, Chicago, Illinois.

FOR SALE: HEADLESS PUSHER BIPLANE with Curtiss 80 A-1 condition, very fast. Also have several propellers will sell reasonable. We will also build complete machines or parts and propellers very reasonable, try us. The New Britain Aero Works, 266 Fairview Street, New Britain, Connecticut.

INTERESTED IN AERONAUTICS? IF SO, why not join a progressive Club. Be associated with those who possess expert knowledge on the construction and flying of model aircraft and aviation in general. Write for information. Aero Science Club of America, Secretary, Engineers Building, 29 West 39th Street, New York City.

PARTNER WANTED: PARTY OWNING Genuine Benoist Tractor plane without motor, wants partner who owns, or can buy good motor to go into exhibition business. Address Box 132, Aerial Age, 280 Madison Avenue, New York City.

NOT THE CHEAPEST, NOR THE DEAREST, but we've few equals in quality. Tractors, Motors, Blue Prints, Propellers, etc. Chicago Aero Works, 326 River Street, Chicago, Illinois.

DAVENPORT SCHOOL OF AVIATION, IS making special inducements to students as we need men for our new factory. Write today for booklet. School and Factory, Davenport, Iowa.

FIRST CLASS FOREMAN FOR METAL DEpartment aeroplane factory. State experience, salary, etc. Replies held confidential. Box 121, Aerial Age, 280 Madison Avenue, New York City.

MODEL AEROPLANES AND THEIR Motors, by George A. Cavanagh.
One of the most comprehensive books dealing upon the subject of model aeroplanes and their motors. The book includes a short history, a complete description of a simple model, World's record Models, compressed air, steam and gasoline engines, models driven by such engines, world's records and a list of definitions of aeronautical words and terms. Price Net $1.00, Aerial Age, 280 Madison Avenue, New York City.

MODELS—MODEL AEROPLANES, ACCESSORIES and supplies. Material suitable for the construction of models that will FLY. Moderate prices. Prompt deliveries. Complete catalog free on request. Wading River Mfg. Co., 550 Macon St., cor. Reid, Brooklyn, N.Y.

LEARN TO FLY, WE OPERATE SCHOOL at Sheepshead Bay Speedway. License Guaranteed. United Eastern Aeroplane Corporation, 1251-1257 DeKalb Avenue, Brooklyn, New York.

CAPABLE MAN, WITH MECHANICAL, ALL round office, purchasing and inspection experience, desires to associate himself with aeromotor manufacturing company. Interview requested. Box 137, Aerial Age, 280 Madison Avenue, New York City.

WANTED: POSITION AS FLYING INstructor. Five years' experience monoplane and biplane. Taken Curtiss License here. Box 135, Aerial Age, 280 Madison Avenue, New York City.

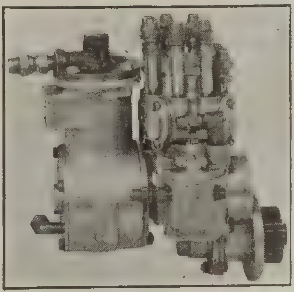
BUSINESS CHANCE: I OWN GOOD HUNdred horse-power motor and want party to furnish exhibition machine or airboat for same and share profits. Address Box 133, Aerial Age, 280 Madison Avenue, New York City.

TWO MOTORS, 90 H.P., WELL-KNOWN make, brand new, for sale. Bargain if purchased immediately. Box 127, Aerial Age, 280 Madison Avenue, New York City.

WANTED: DRAUGHTSMEN, DESIGNERS, mechanics and woodworkers; send full particulars as to past and present employment, qualifications, references, salary, etc. Box 138, Aerial Age, 280 Madison Avenue, New York.

WANTED: AIRPLANE AND MOTOR DEsigners, tracers, assemblers, and workmen of all kinds. Give complete details of experience and wages wanted. Egbert B. Cresswell, care of Aerial Age.

Starts High Powered Engines Cold on Low Pressure



Supplied to the U. S. Navy

THE marked efficiency of the Christensen Self Starter is perhaps best suggested by the results of a test on a Hall-Scott Motor made at the Standard Aero Mfg. plant in Plainfield, N. J. There on a tank of air of 250 pounds pressure, 28 complete starts were made without recharging the tank, and the last start was made on the low pressure of 100 pounds.

"Start Your Engine From Your Seat"

(WRITE FOR BOOKLET)

THE CHRISTENSEN ENGINEERING CO.
MILWAUKEE, WIS.

The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

The Buck Aircraft & Munition Co., Inc.
Ernst and Cranmer Building
Denver, Colo.

New York Office
Room 327, 42nd St. Building

Beam School of Aviation

CELINA, OHIO

Now offering special inducements to students enrolling in winter classes.

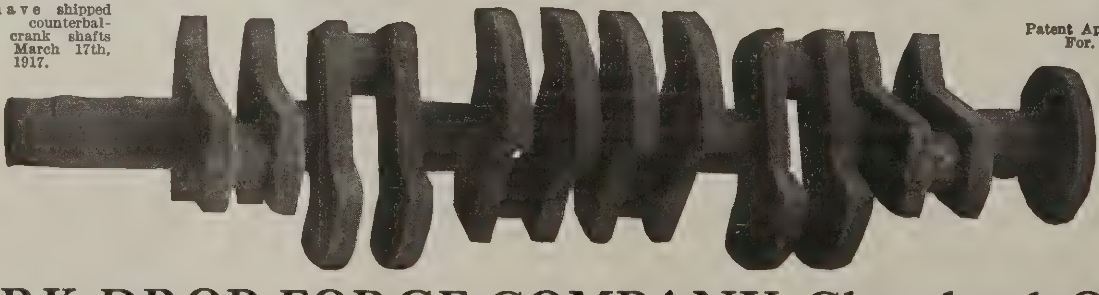
The rarest opportunity in the history of aviation. Best equipment. Living expenses very reasonable. Factory experience.

Write, wire or call now and make your reservations for tomorrow may be too late.

COUNTERBALANCED

We have shipped 39,216 counterbalanced crank shafts up to March 17th, 1917.

Patent Applied For.



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SPERRY Aeronautic Apparatus

Automatic Pilot—
Controls the Airplane.

Synchronized Drift Set—
Automatically Corrects the Compass for All Drift.

The Sperry Gyroscope Company
Manhattan Bridge Plaza
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London, S. W.

NORMA

BALL BEARINGS

(Patented)

Can you afford to risk the trouble, the danger, the possible disaster, which will follow the failure of a bearing in your magneto? Be **sure**—see that your magnetos are NORMA equipped.

THE NORMA COMPANY OF AMERICA
1790 BROADWAY NEW YORK
BALL, ROLLER, THRUST, COMBINATION BEARINGS

Aeroplane Spruce

Close, Straight Grain, 4 Sides Clear

Guaranteed to be the Finest and Strongest aeroplane timber offered

PRICES AND SPECIFICATIONS:

10 to 30 Feet in length
2 inches thick
6 inches wide and wider
Price, $130.00 per 1000 Feet.

18 Feet and longer
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Price, $140.00 per 1000 Feet.

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3 inches thick and thicker
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All Vertical Grain
Price, $155.00 per 1000 Feet.

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Selection and inspection, New York City
Immediate delivery
Price, $150.00 per 1000 Feet.

AEROPLANE HICKORY
Cut in dimensions to order
Sample stock on hand
Price upon application.

ISRAEL LUDLOW
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An Opportunity

WHEN you buy advertising space you have merely purchased an Opportunity. The *use* made of that Opportunity is the Big Thing.

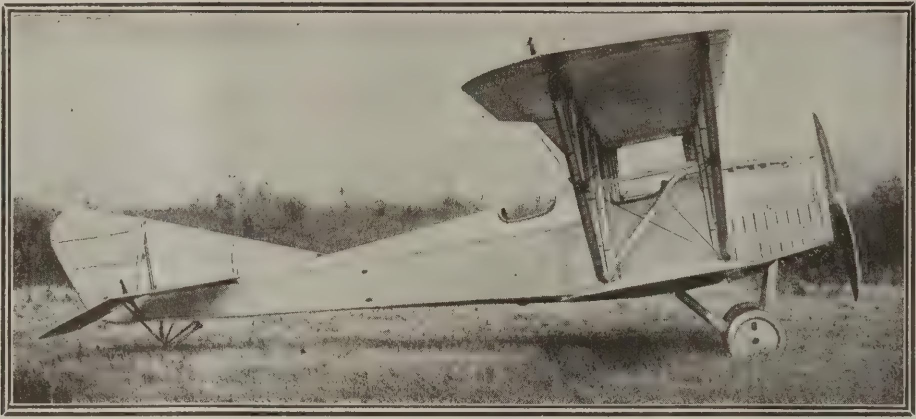
The Question is: What are you going to do with that Space?

We are prepared to answer this question for you. AERIAL AGE Advertisers' Service Department exists for just that purpose.

Exceptional artists and writers, with special training and abundant experience, not only in general advertising but *particularly with regard to advertising aeroplanes, aero-motors and accessories,* stand ready to fill that space for you in the manner best suited to your needs.

This Service Department is maintained entirely for your benefit, in order that you may obtain the best possible results from your advertising appropriation.

USE IT!



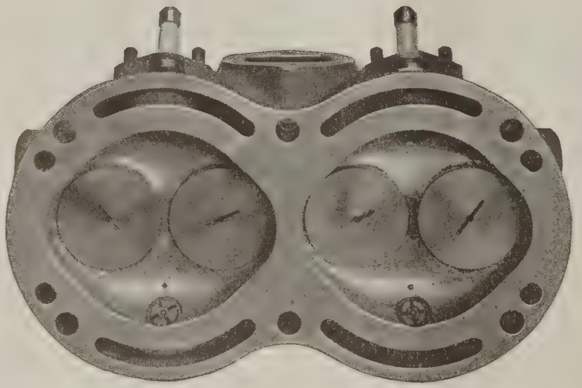
THOMAS D-5 RECONNAISSANCE TYPE

A new **Thomas type** designed especially for military purposes, combining unusual **strength** of **construction, stability** and **controllability.**

Contractors to U. S. Army and Navy

THOMAS-MORSE AIRCRAFT CORPORATION

Successors to THOMAS BROS. AEROPLANE CO., INC.
THOMAS AEROMOTOR COMPANY, INC. *Ithaca, N. Y.*



Sturtevant
(REG. U.S. PAT. OFF.)

CYLINDER HEADS

The aluminum cylinder heads of the Sturtevant Aeronautical Engine are completely water-cooled with ample passages for unobstructed circulation of the cooling water around the valves. Cast iron valve seats are employed.

Overheated valves are an unknown trouble in the Sturtevant engine.

B. F. STURTEVANT COMPANY
Hyde Park -:- Boston, Mass.

THE STATEN ISLAND AVIATION SCHOOL Will Teach You To Fly

By LAND or WATER

LATEST BENOIST MODELS.
Machines built with 2 controls especially for this school.

FULL COURSE OF 25 LESSONS, $250.00

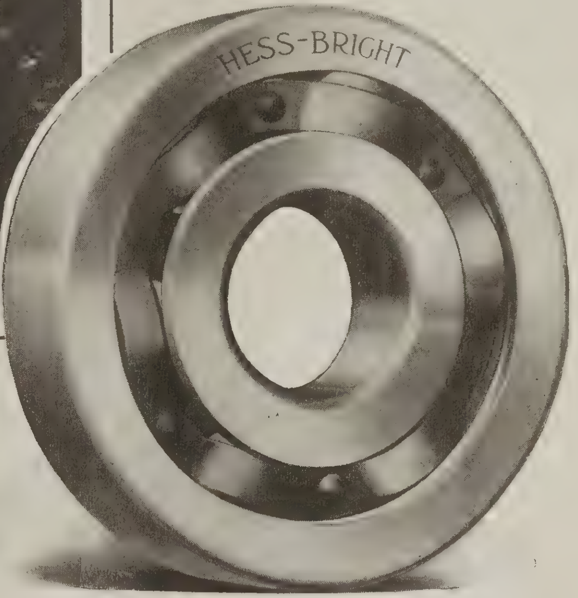
ONE PRELIMINARY LESSON - - $25.00

For Booklet and Information apply:

New York Office, 119 LEXINGTON AVENUE, NEW YORK
'PHONE: MAD. SQ. 8916.
FLYING FIELD—GRAHAM BEACH
(Adjoining Midland Beach).

It takes KNOWLEDGE—PLUS

To produce ball bearings of HESS-BRIGHT quality requires all the knowledge that can be summoned —*plus* the desire and positive intention to make a ball bearing that shall be commensurate with the aims and ideals of an organization that stands for nothing but the best.



To produce something of inferior quality, only a little knowledge and less care, are necessary.

THE HESS-BRIGHT MANUFACTURING CO.

PHILADELPHIA, PA.

Hess-Bright's Conrad Patents are thoroughly adjudicated.

ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps, and Sperry Map Holder, supply this necessity.

The map can be turned easily in the holder bringing constantly before the aviator a chart of the locality above which he is flying.

The equipment is light in weight and can be fixed to instrument board without interference with the other instruments.

Prices and details on application.

The Aeronautic Library, 280 Madison Avenue, New York City

AVIATION TRAINING

THE CURTISS School of Aviation will give training this winter, in Florida, to those civilians who may be accepted by the Aviation Section, U. S. A., upon their having made application for enlistment in the Aviation Reserve Corps. Applicants must be between twenty-one and twenty-seven years of age, possess good health, character and college education or equivalent. Tuition will be paid by the Government.

FOR FURTHER INFORMATION WRITE

THE CURTISS TRAINING SCHOOLS

CHURCHILL STREET, BUFFALO, N. Y.

Curtiss

Military aviation training under Aviation Section United States Army supervision at our established schools at Newport News, Va., and Miami, Fla.

Curtiss

CAREY PRINTING COMPANY, INC.

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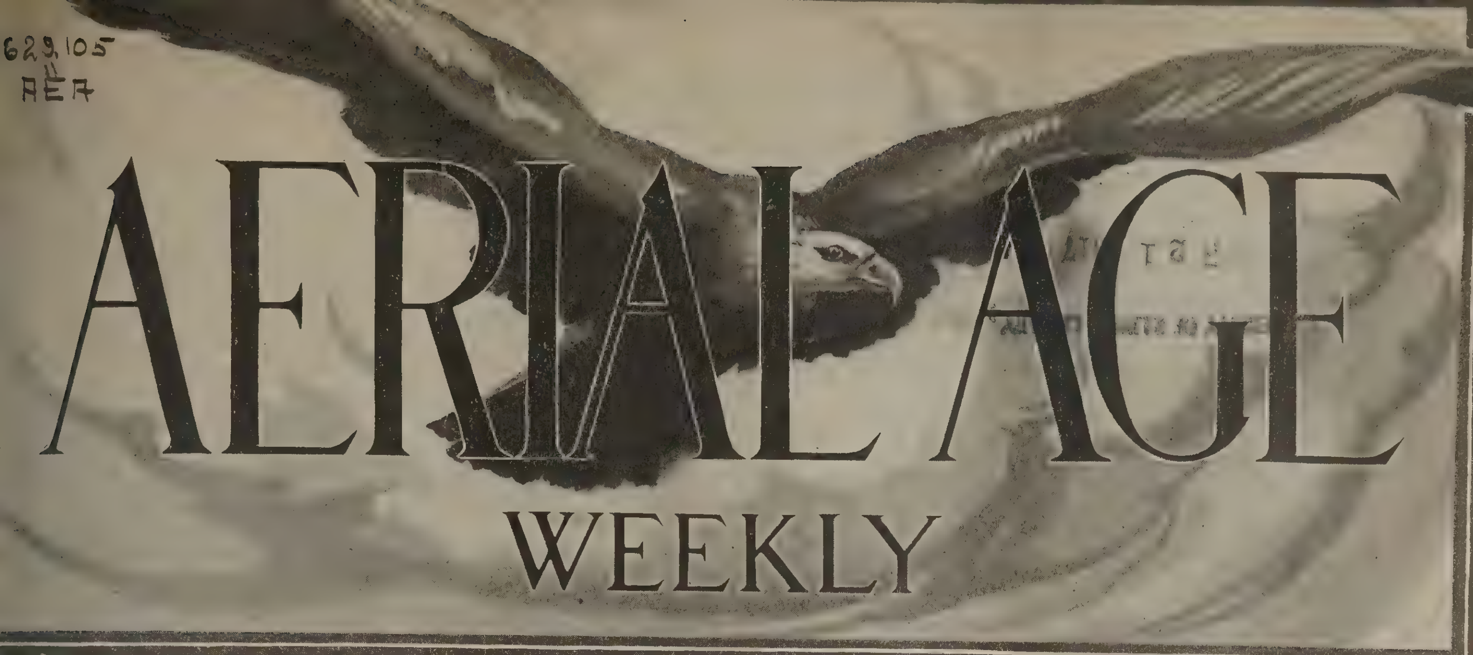


AERIAL AGE WEEKLY

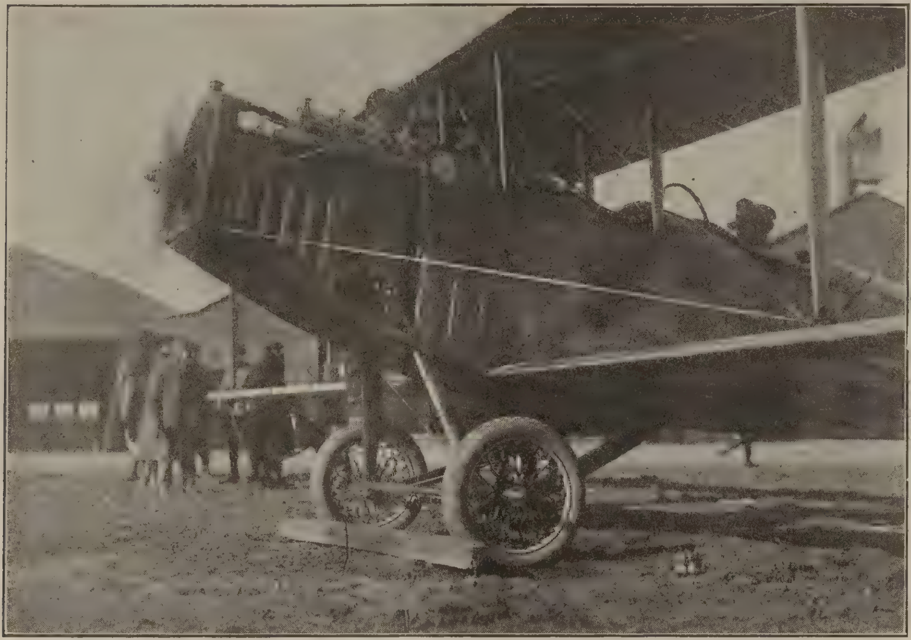
Vol. 5, No. 5 APRIL 16, 1917 10 CENTS A COPY

Congressman Murray Hulbert Introduces Bill Creating Department of Aeronautics

American Battleplanes--Illustrated and Described

How to Join the Aviation Section of the Signal Officers' Reserve Corps

Second Annual Report of the National Advisory Committee for Aeronautics



Curtiss J. N.
Tractor
Equipped With
Ackerman Wheels

"IT'S IN THE SPOKES"

AFTER four years' exhaustive tests, The Ackerman Wheel Company offers to aeroplane builders a wheel of special design that will solve many of the difficulties hitherto encountered.

In a series of laboratory tests (see illustrations below) the wheel was attached to a large case, into which was loaded 1,500 pounds of sand. A side thrust blow, with the wheel seven feet removed from the point of contact, was calculated to give the wheel a stress of 27,000 pounds. This was when the wheel struck the plain floor surface. To test the wheel to its maximum, two cleats of wood were nailed to the floor, four inches in advance of the striking point, and under this test four spokes of the wheel were broken. Calculation showed that the energy of the blow totalled 49,800 pounds.

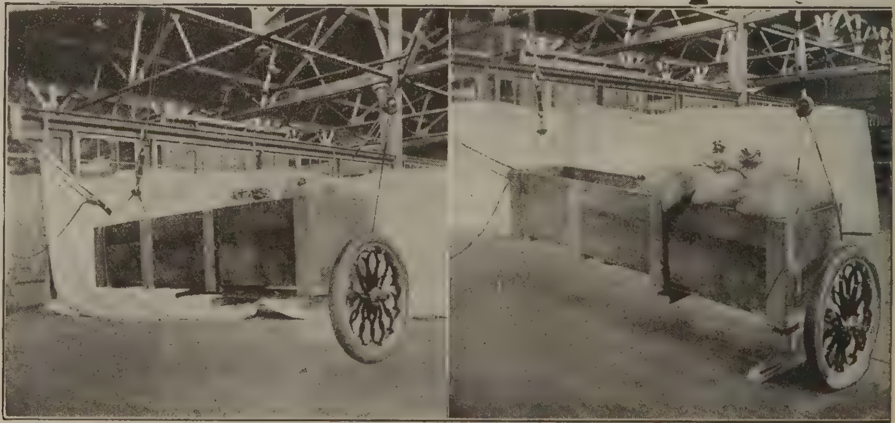
A special alloy, specially treated, is used to meet all conditions that the wheel can be subjected to. The steel receives a special process in the treating, so that it will give the required resiliency, starting at the center of the curve and gradually growing stiffer and stronger both to the hub and relative to the structure of the spoke. The spokes being made on the curve, they are hung on the hinge at the rim, being a unit in the hub, allowing them to open and shut according to the load placed on the hub.

In the aeroplane wheel it is found that the hub will leave the center four inches when maximum loaded, and return to center as load is decreased, without the springs taking a set. There has never before been a wheel invented which would meet any such conditions.

These wheels can be built according to size and weight of any load from 500 pounds up to 5 tons

Write for complete information to

THE ACKERMAN WHEEL COMPANY
Rockefeller Building, Cleveland, Ohio



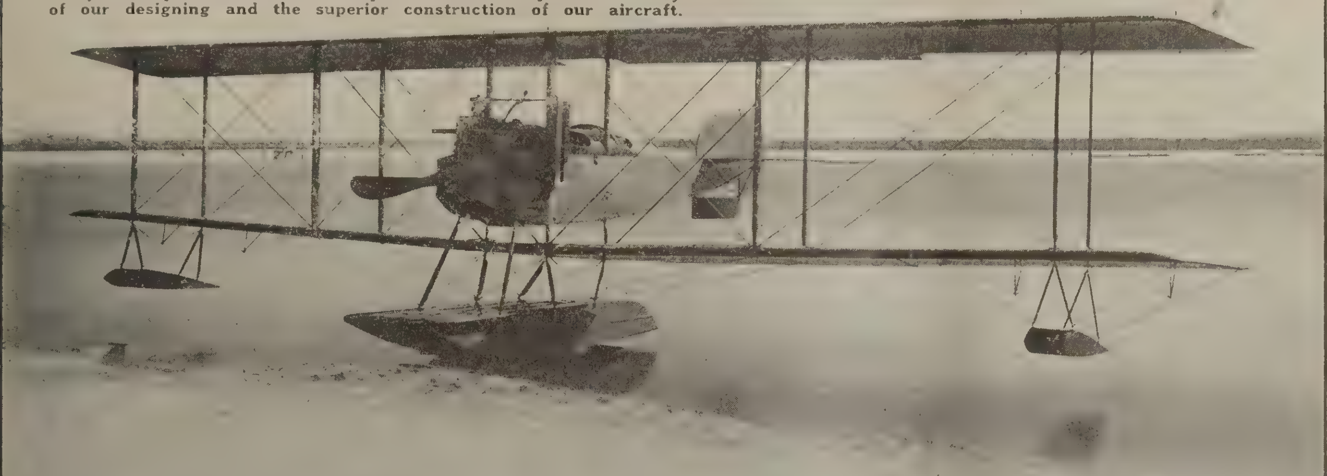
THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

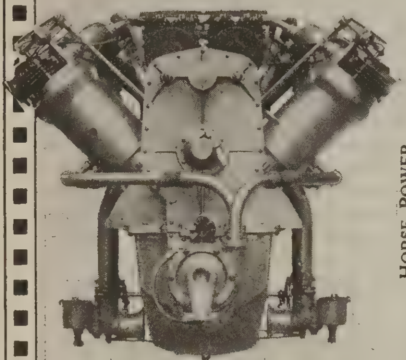


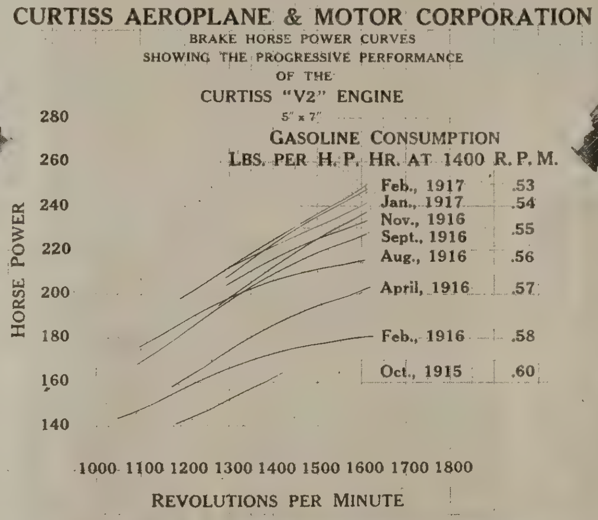
WRIGHT-MARTIN AIRCRAFT CORPORATION
60 Broadway -:- New York

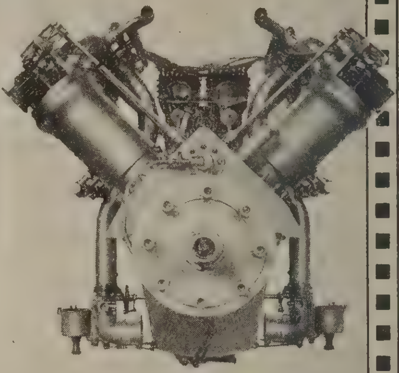
When a Hess-Bright Equipped Aeroplane goes aloft, the Pilot may be confident that his flight is aided by the nearest possible approach to *Bearing Perfection*

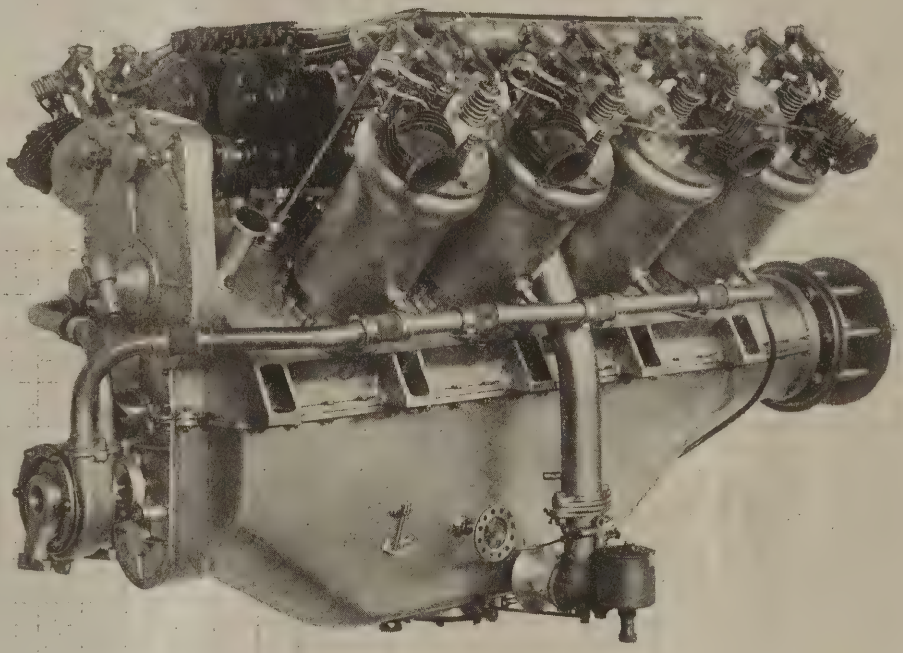
THE HESS-BRIGHT
MANUFACTURING CO.
Philadelphia Pennsylvania

Hess-Bright's Conrad Patents Are Thoroughly Adjudicated









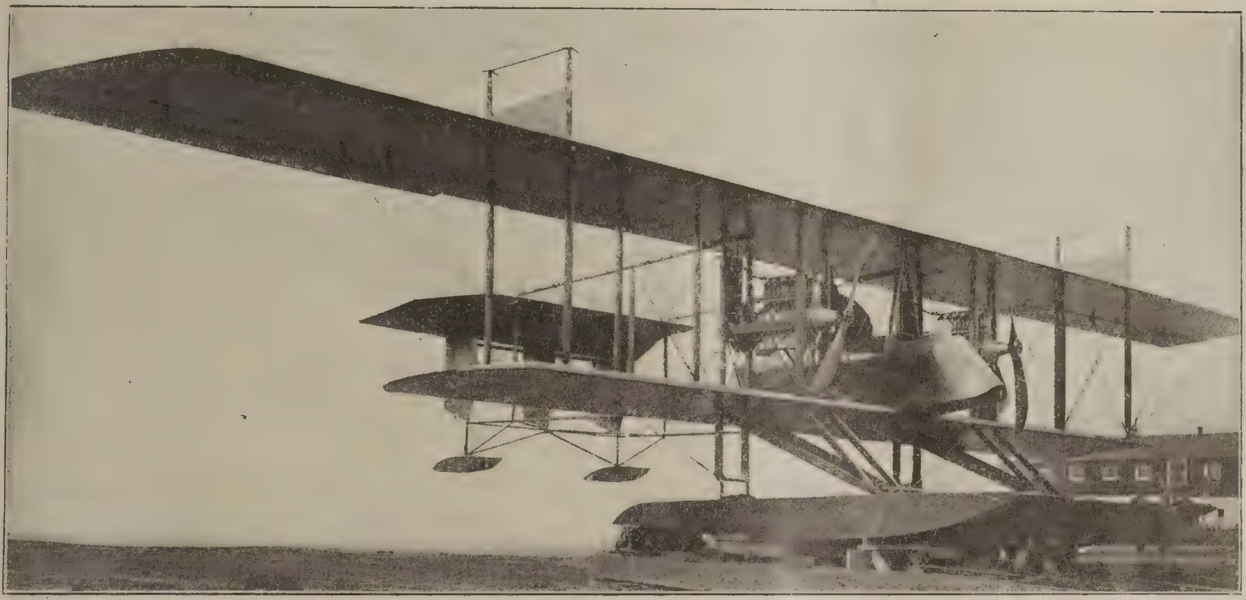
Curtiss

The motor shown above is a Curtiss 8-cylinder, Vee, 4 stroke cycle, rated at 200 H.P. at 1400 R.P.M. Double ignition, two high tension—8-cylinder magnetos. Water cooled—centrifugal pump. Oiling, force feed to all bearings. Weight, with propeller hub, 72 pounds. Full information and installation dimensions gladly furnished on request.

CURTISS AEROPLANE & MOTOR CORPORATION

BUFFALO, N. Y.

PERFORMANCE!



NEW YORK AERO CONSTRUCTION

TWIN MOTORED SEAPLANE

820 sq. ft. Supporting Surface	Maximum Speed 85 Miles per hour
Two 100 h.p. Aero-Marine Motors	Minimum Speed 43 Miles per hour
Weight 2,700 lbs. Useful Load 1,700 lbs.	Flying Radius Nine Hours

LEAVES WATER IN 50 FEET

Designed and constructed throughout under the supervision of Mr. Warren S. Eaton

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NEW YORK AERO CONSTRUCTION CO.

FACTORY:
Newark, New Jersey

SPHERICAL BALLOON FABRIC STANDARDIZED

AFTER thorough investigation of theory and practice here and in Europe, we have standardized our balloon fabrics on the bases of tensile strength, diffusion and coating.

Years of successful manufacture of these fabrics and of spherical balloons have given us the necessary verification by experience for the principles developed in our laboratories.

Our 80,000 cubic feet capacity Goodyear Spherical which won the international race at Paris in 1913 is one of a number of successes.

We have since built a number of balloons of similar type and of various sizes.

Our aeronautical experts will gladly answer inquiries regarding our fabrics and principles of balloon construction.

We manufacture Rubberized Fabric—Spherical, Kite and Dirigible Balloons of any size, every type and for any purpose—sporting, exhibition, military and naval—Aeroplane Tires, Tubes, Rubber Bumpers, Rims and other aeronautical supplies.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
AKRON

B. H. KENDRICK

WILL

INSTRUCT

A limited number of intelligent students in the

ART OF FLYING SUCCESSFULLY

SPECIAL ATTENTION GIVEN TO AERIAL COAST PATROL UNITS

Students are assured of Immediate Delivery of Seaplanes if they desire to own their machine upon completion of their course

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AERIAL AGE
WEEKLY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Inc., Foster Building, Madison Avenue and Fortieth Street, New York City
Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879
Subscription Price, $4.00 a year, Foreign, $5.00. Telephone, Murray Hill 7489

VOL. V NEW YORK, APRIL 16, 1917 No. 5

THE STAR SPANGLED BANNER

Oh, say, can you see, by the dawn's early light,
What so proudly we hailed at the twilight's last gleaming,
Whose broad stripes and bright stars, thro' the perilous fight,
O'er the ramparts we watch'd, were so gallantly streaming?
And the rocket's red glare, the bombs bursting in air,
Gave proof thro' the night that our flag was still there.
Oh, say, does that star-spangled banner yet wave
O'er the land of the free, and the home of the brave?

On the shore, dimly seen thro' the mists of the deep,
Where the foe's haughty host in dread silence reposes.
What is that which the breeze, o'er the towering steep,
As it fitfully blows, half conceals, half discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected, now shines on the stream;
'Tis the star-spangled banner; oh, long may it wave
O'er the land of the free, and the home of the brave.

And where is that band who so vauntingly swore,
That the havoc of war and the battle's confusion,
A home and a country should leave us no more?
Their blood has wash'd out their foul footsteps' pollution,
No refuge could save the hireling and slave
From the terror of flight or the gloom of the grave:
And the star-spangled banner in triumph doth wave
O'er the land of the free and the home of the brave.

Oh thus be it ever when freemen shall stand
Between their lov'd home and wild war's desolation;
Blest with victr'y and peace, may the heav'n-rescued land
Praise the Pow'r that hath made and preserv'd us a nation!
Then conquer we must, when our cause it is just,
And this be our motto: "In God is our trust!"
And the star-spangled banner in triumph shall wave
O'er the land of the free, and the home of the brave.

"Will you please print the Star Spangled Banner?" has been a common request since the Aero Club of America, very thoughtfully, had this stirring national song printed—and was sung by Geraldine Farrar and the 500 guests at the club's annual banquet.

We have gone to patriotic meetings and have seen enthusiastic Americans chagrined because they could not remember the words of the second and third verses of the Star Spangled Banner. They usually mean to buy a copy of the song, but always forget.

We will print the Star Spangled Banner—and, very appropriately—as the leading editorial.

CONGRESSMAN MURRAY HULBERT INTRODUCES A BILL CREATING DEPARTMENT OF AERONAUTICS

Congressman Murray Hulbert, of New York, one of the most forceful spokesmen for aerial preparedness in Congress, has introduced a bill creating a Department of Aeronautics, with a Cabinet Officer as Secretary of Aeronautics.

The Bill reads as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there be at the seat of government an executive department known as the Department of Aeronautics, and a Secretary of Aeronautics, who shall be the head thereof; and the provisions of title four of the Revised Statutes, including all amendments thereto, are hereby made applicable to said department. The Secretary of Aeronautics shall be appointed by the President, by and with the advice and consent of the Senate, at a salary of $12,000 per annum and with tenure of office like that of the heads of other executive departments; and said Secretary shall cause a seal to be made for the Department of Aeronautics of such device as the President approves, and judicial notice shall be taken of said seal.

SEC. 2. That there be in the Department of Aeronautics an Assistant Secretary of Aeronautics, to be appointed by the President, who shall receive a salary of $5,000 per annum. He shall perform such duties as are required by law and such as are prescribed by the Secretary of Aeronautics. There shall also be a chief clerk whose salary shall be $4,000 per annum, a disbursing clerk whose salary shall be $4,000 per annum, an editor whose salary shall be $4,000 per annum, and such other employees as Congress may from time to time authorize. The Auditor for the State and Other Departments shall receive and examine all accounts of salaries and incidental expenses of the office of the Secretary of Aeronautics and of all bureaus and offices under his direction and all accounts relating to all other business within the jurisdiction of the Department of Aeronautics, and shall certify the balance arising thereon to the Division of Bookkeeping and Warrants of the Treasury Department and forthwith send a copy of each such certificate to the Secretary of Aeronautics.

SEC. 3. That it shall be the province and duty of the Department of Aeronautics to supervise and promote all matters pertaining to aeronautics in its relation to the Army and Navy in times of war and peace and to endeavor to improve and develop the science of flying as may be deemed desirable in the public interest and for the purpose of extending commerce on such other ends as may be found practicable for the general betterment of the country, and said department shall collect and disseminate information relating thereto as the needs may require.

SEC. 4. That to the Department of Aeronautics are hereby transferred the aeronautic section of the Signal Corps of the Department of War and the Office of Naval Aeronautics of the Department of the Navy, and all that pertains to them are hereby transferred to the Department of Aeronautics, and they and each of them shall remain under the supervision and direction of the Secretary of Aeronautics until otherwise directed by law.

And the President is hereby authorized to transfer to the Department of Aeronautics at any time either the whole or any part, as to him may seem best, of any bureau, division, or other branch of the Government engaged in work pertaining to aeronautics.

And each and every function, authority, power, duty, and jurisdiction of whatsoever character it may be, vested at the time of any transfer aforesaid in the head of the executive department from which such bureau, division, or other branch of the Government is transferred, shall, to the extent to which such function, authority, power, duty, or jurisdiction pertains to such bureau, division, or other branch of the Government, immediately upon such transfer become vested, and hereafter remain vested, in the Secretary of Aeronautics.

All lands, buildings, furniture, apparatus, equipment, and property of whatsoever description, and all official records and papers in the custody of any executive department from which any bureau, division, or other branch of the Government is transferred as aforesaid and pertaining to the business of such transferred bureau, division, or other branch of the Government shall at the time of such transfer, or as soon thereafter as practicable and in so far as such action can be taken without hindering the work of the executive department from which such transfer is made be given over into the custody of the Department of Aeronautics. And all unexpected balances of appropriations available at the time of such transfer for the use of any such transferred bureau, division, or other branch of the Government, or which may become available thereafter, shall be and remain available in similar manner and to the same extent as if no transfer had been made.

Sec. 5. That within the Department of Aeronautics there shall be the following bureaus:

(a) Bureau of Land Operations.
(b) Bureau of Naval Operations.
(c) Bureau of Radio Communications.
(d) Bureau of Construction.
(e) Bureau of Aeronautic Research.
(f) Bureau of Motor Power.
(g) Bureau of Personnel and Accounts.

There shall be a chief of each of the above seven bureaus, to each of whom shall be paid a salary of $5,000 per annum: *Provided, however,* That any officer of the Army or Navy serving on detail in one of the aforementioned bureaus as chief, or in any other capacity, whose salary and allowances in the Army or Navy exceeds $5,000, shall be paid an additional sum, so that his salary of $5,000 per annum and the said additional sum shall equal the pay and allowances due him as an officer of the Army or Navy.

And the Secretary of Aeronautics is hereby authorized to arrange and rearrange from time to time, with the approval of the President, the functions, duties, personnel, papers, records, and property, and the work, resources, and equipment generally coming into the jurisdiction and control of the Department of Aeronautics by the operation of this Act, so as most efficiently and economically to organize and maintain the several bureaus herein named and such divisions and officers thereof as to said Secretary seems proper.

Sec. 6. That for the purpose of efficient organization at the outset of the operations of the Department of Aeronautics, officers and enlisted men of the Department of War and the Department of the Navy who are now detailed in the aeronautic service and are hereby considered as in the service of the Department of Aeronautics, and shall be detailed for duty as may be seen fit by the Secretary of Aeronautics, after consultation with the Secretary of the Navy and the Secretary of War, and for a period not to exceed four years, unless otherwise provided for by law.

Sec. 7. That the Secretary of Aeronautics may, in his discretion and with the approval of the President, appoint an advisory board of not more than seven members to confer with him upon his request, from time to time as he deems necessary, concerning the work of the Department of Aeronautics. The members of said board shall be selected because of their special knowledge of matters relating to aeronautics and flying, and each shall hold office for a term of seven years, or until his successor is appointed, except that the appointments first made, and appointments thereafter made to fill unexpired terms and tearms of members who have held over beyond the periods of their original appointments, shall be made so that no more than one member shall retire during any one fiscal year. No member of any such advisory board shall receive any compensation for his services, but each shall be paid all actual expenses necessarily incurred in the discharge of his duties. They shall automatically become additional members of the National Advisory Committee for Aeronautics, created by an Act entitled, "An Act making appropriations for the naval service for the fiscal year ending June thirtieth, nineteen hundred and sixteen," approved March third, nineteen hundred and fifteen.

Sec. 8. That the Secretary of Aeronautics shall annually submit to Congress a report in writing showing the operations of the Department of Aeronautics during the last preceding fiscal year, which report shall give an account of all moneys received and all moneys disbursed on account of such operations. He shall make such other reports from time to time as may be required by the President or by either House of Congress and such as are in his judgment necessary or expedient.

Sec. 9. That $1,000,000 be, and the same are hereby, appropriated to carry into effect the provisions of this Act, out of any money in the Treasury not otherwise appropriated, in addition to all continuing funds and all other sums now available for Army or Navy aeronautics, or which may be made available for aeronautics in any manner whatsoever by the present session of Congress.

Sec. 10. That all Acts and parts of Acts contrary to the provisions of this Act or inconsistent therewith be, and the same are hereby, repealed.

Sec. 11. That this Act shall take effect on and after July first, nineteen hundred and seventeen.

The Aero Club of America has been urging the establishment of a Department of Aeronautics for the past two years, so as to bring about a closer co-operation between the Army and Naval Air Services, and the co-ordination of military and civilian resources. Two years ago, before the Club declared itself in favor of the Department of Aeronautics, Mr. Alan R. Hawley, President of the Club, was mentioned as the logical Secretary of Aeronautics, to be a member of the President's Cabinet. But Mr. Hawley stated then that he would not under any consideration accept an office of any kind, feeling that he could do just as much, perhaps more, work for the country as President of the Aero Club of America, or as a worker for the upbuilding of our national defenses. Mr. Hawley put himself on record in Congress and with the press at the time as declining to accept any office. As his name has been mentioned during the past two weeks as the logical Secretary of Aeronautics, Mr. Hawley has authorized the statement that he cannot consider, and will not accept any official position—but will be glad to continue to give his entire time, energies and resources to the upbuilding of the nations aerial defenses and other national work.

CONSTRUCTIVE PATRIOTISM

TO meet the serious need for a large number of aviators in connection with the upbuilding of our aerial defenses, steps are being taken to establish a huge aviation training camp for college men.

Messrs. Henry P. Davison, of J. P. Morgan & Co., Lewis Thompson, another wealthy New Yorker, and F. Trubee Davison, who organized Volunteer Aerial Coast Patrol Unit No. 1, are developing a plan, in co-operation with the naval authorities, the National Aerial Coast Patrol Commission, of which Admiral Peary is the Chairman, and the Aero Club of America.

The decision to establish this huge training camp, which will easily accomodate 100 students, was reached following the consideration of the need for aviators for the Aerial Coast Patrol of the Second and Third Naval Districts, which brought out the fact that not less than 3,000 aviators, 50 dirigibles balloon pilots, and 100 observation balloon operators are needed for the defense of these two naval districts.

The duties of the Aerial Coast Patrol are to be as follows:

(1) To locate and assist destroyers, trawlers and submarine chasers in capturing or destroying hostile submarines.

(2) To locate submerged mines and assist trawlers in destroying mines.

(3) Searching the coast for submarine bases.

(4) To convoy troop and merchant ships and coastwise trips.

(5) To patrol the coasts, holding up and inspecting doubtful ships and convoying them to examining stations.

(6) Attacking hostile ships and submarines that may show up near the coasts, with torpedoes, bombs and guns.

(7) Protecting ships at sea and in ports against attack from hostile submarines and battleships.

(8) Communicating to incoming ships information regarding the location of mines, submarines and the courses to follow to avoid mistakes and confusion.

(9) Serving as the "eyes" of mine planters, minimizing the time required for mine planting.

(10) Defending and protecting naval bases and stations from naval and aerial attacks.

It was after considering the vital need of aviators for the Aerial Coast Patrol and the realization of the fact that in case of war the fifty or so U. S. naval aviators available would be merely a drop in the bucket, that made the Davisons decide last summer to organize a unit of the Aerial Coast patrol. That unit was formed on July 7th last, and the twelve members trained continuously throughout the summer at Port Washington, and during the fall at New London, in co-operation with the officers of the Navy Yard there. The unit also participated in the Mosquito Fleet maneouvers held at Gravesend Bay from September 5th to 12th, during which they gave remarkable demonstrations of their efficiency and of the value of the Aerial Coast Patrol as a whole.

MEMORIAL—TO PETER CARL (TEX.) MILLMAN

Time in its tireless flight, has brought us again to the full realization that the Grim Reaper is ever amongst us. Life at best is frail and may be taken from us or blown out in a brief second as a candle in a gale.

Little we thought that you, "Tex," our Chief Instructor, congenial associate, co-worker and friend, would be, could be taken away to the Great Beyond after one week of illness.

We hoped on, prayed on for you while you were away, and now that you are gone, we will always remember you as a most willing and earnest worker of the Flying Service.

Your star will shine in the firmament and your brother pilots will look for you there. We cannot say, we will not say, that you are gone, you are just away.

Years may roll on with their sunshine and shadows, laughter and tears, sowing and reaping, cradle songs and funeral hymns, but your memory will ever live with us.

To those near and dear to you, we, the Officers, Instructors, Soldiers and Civilian Employees of the Aviation Station, at Mineola, extend our heartfelt sympathy, and feel deeply for them in their bereavement.

At the time of Germany's declaration of her intention to prosecute a campaign of ruthless U-boat warfare, the Davisons and all the members and officials of the Aerial Coast Patrol Commission and the Aero Club of America, realized that this policy might mean the involving of this country in war, and that in such a case there would be needed many aviators for coast patrol duties. The 29 members of Volunteer Aerial Coast Patrol Unit No. 1 made plans to leave Yale University and go to Florida to continue their training, so as to be available and to be thoroughly trained in case of emergency.

The report that the Unit was to go to Florida for training stirred up tremendous interest among the students at Yale, Princeton, Columbia, Harvard and other Universities, and as a result, the Unit was flooded with hundreds of applications from college men anxious to join the Unit and to form other units.

Arrangements were made for Unit No. 1 to take on 2 additional members, making 29 members in all, to the aviation training camp established by Mr. Rodman Wanamaker, at West Palm Beach. Mr. Lewis S. Thompson agreed to assist the Davisons in this patriotic work, and as Mr. H. P. Davison, Sr., could not himself go to Florida, Mr. Thompson took charge of the general supervision of the Unit. Messrs. W. D. Gash, who is Mr. Rodman Wanamker's right hand man, Stuart McDonald, manager of the Aviation School, and David McCulloh, the chief pilot of Mr. Wanamaker's school, are co-operating with and assisting Mr. Thompson. As the demand for training was so large, and in view of the approaching emergency, it was decided to give the Unit a military formation, which was done. The Camp at West Palm Beach is running on a military basis, the members of the Unit getting training in discipline, aerial gunnery, wireless, and general aerial coast patrol work, as well as in the operation of aeroplanes.

Mr. Henry Woodhouse, a member of the Board of Governors of the Aero Club of America has presented to the Unit, through the Aero Club of America, a Lewis aeroplane gun, with 2,000 rounds of .333 ammunition, to enable the Unit to get practical experience with an up-to-date aeroplane gun.

The plan was to have Unit No. 1 train at West Palm Beach until the weather permitted establishing a camp on Long Island. While the plans for this camp were being considered, the applications for training from college men became so numerous that the patriotic people who are contributing towards the training and equipping of aerial Coast Patrol Unit No. 1 decided to extend their support so as to increase the number of men to be trained to 100.

The plan was submitted to the Navy Department, and the authorities have given valuable suggestions, and are co-operating in carrying it out. This camp is to be established on Long Island, near New York, and several cities are under consideration.

The 29 men now under training at West Palm Peach represent some of the most prominent families in the United States, and are as follows: F. Trubee Davison and Henry P. Davidson, Jr., sons of Henry P. Davison, member of the firm of J. P. Morgan & Co.; Robert A. Lovett, son of Judge Lovett, Chairman of the Executive Committee of the Union Pacific Railroad; Albert J. Ditman, Charles Wiman, Artemus L. Gates, Allan Ames, John V. Farwell, John Vorys, Earl Gould, Wellesly Laud-Brown, Reginald G. Coombe, Oliver B. James, G. Franklin Lawrence, William Rockefeller, Frederick Beach, Kenneth Smith, Kenneth McKleisch, Curtis Read, Barlow Read, David Ingallis, A. D. Sturtevant, William Thompson, Frank Lynch, Graham Brush, Henry Landon, Samuel S. Walker, Charles Stewart, Archie McIlwaine.

At first, it was thought that there would be difficulty in getting the aeroplanes needed for the training camp, but the investigation of the National Advisory Committee on Aeronautic showed that the aeroplane manufacturers are ready to extend their facilities so as to supply 5,000 aeroplanes this year, provided that orders for continuous deliveries are given. Heretofore the Government has only placed orders for immediate deliveries, and the manufacturers having nothing to look forward to, could not extend their facilities to create greater sources of supply, but now that the National Advisory Committee on Aeronautics has decided to have the Army and Navy place large orders for continuous deliveries, extending over two or three years, the manufacturers are going ahead developing their facilities and purchasing materials needed in the manufacture of aeroplanes and motors, and will be able to begin to make substantial deliveries in a very short period of time.

National Advisory Committee on Aeronautics Prompt in Taking Steps for Developing Our Aerial Defenses

THE patriotic people who, for the past two years, have contributed their efforts—and considerable money—to developing our aerial defenses will be gratified to learn that the National Advisory Committee on Aeronautics has been prompt in taking steps for developing our aerial defenses.

To-day is the day of National appreciation for the energetic efforts of those who worked untiringly in the past three years to develop our defenses and who, by personal contributions and sacrifices, sought to prepare the nation for the present emergency. And it is also the day of appreciation for the efforts of those who, in the past two weeks, have been working preparing plans which are to give the United States an adequate air service.

Dr. Charles D. Walcott, the chairman of the Executive Committee of the National Advisory Committee on Aeronautics, is to be congratulated upon the work of his committee.

It is indeed gratifying to be able to tell the hundreds of anxious patriots who inquire at the Aero Club of America, at our offices, and at other patriotic organizations, whether substantial steps are taken to prepare this country that we are preparing, at last!

These patriots are too patriotic to want to know in details; they appreciate that public interest demands that any facts about our preparedness which may help the enemy must be withheld from publication, and accept the statements of the leaders of the national defense moevment regarding the status of things.

Let us hope that the plan to train 2,500 aviators by the end of the year will be put into effect, so that every minute of flying weather can be used to train aviators for national defense!

America Awakes

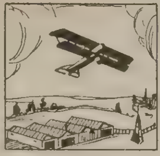
America has waked at last.
The fearless Eagle screams his rage.
Insult and Murder of the past
Have loosed the barriers of his cage,
Where Liberty has sat in tears,
In sorrow bound these awful years;
In hope the bitter cup might pass,
Alas! that hope is vain, Alas!

But, since it has to be, my friends,
Each man give up his selfish ends
And aught that love of country bars,
Unfurl the glorious "stripes and stars."
Though deep in slumber wrapped so long,
When once aroused, like giant strong,
America will rise in might
Prepare and join in any fight.

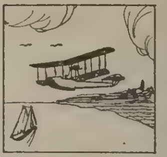
Protecting helpless mortals riven,
Whose only crime is they have striven
To carry out the world's decree,
Based on a great humanity.
America has raised her head;
The spirit that seemed almost dead
Has burst into celestial fire
Her soul filled with a righteous ire.

Thou enemy of God, beware!
Thou ruthless vandal, have a care.
From east to west and back again,
As grows the stream with winter rain,
The soul of Washington revives,
And Lincoln's life goes through our lives.
The world cries out with clarion voice,
"America's awake! Rejoice!"

George L. Upshur.



THE NEWS OF THE WEEK



N. Y. City to Present Aviation Field

New York City.—In response to a request from the Army and Navy Departments, the city will lease to the Government at an annual rental of $1 a year sixty acres of city land within the limits of Rockaway Park for an aviation base. The Mayor has called a special meeting of the Sinking Fund Commission and the request will be formally granted.

The request for the land was made in the following letter to the Mayor from the Secretaries of the Army and Navy Departments:

"The present emergency demands immediate establishment of this station for the protection of New York City and the patrol of its outside waters. It is therefore requested that you take such action as will enable the two Departments to have the earliest possible use of the site."

Aerial Paul Revere

New York City.—Designating Thursday, April 19, the anniversary of the battle of Lexington, as a national recruiting day, Alexander J. Hemphill, chairman of the committee on recruiting of the Mayor's defense committee, has telegraphed the Mayors of 531 cities asking their co-operation in bringing the Army and Navy up to war strength.

As part of the program the committee has arranged to duplicate Paul Revere's ride, to have the poem of Paul Revere recited in all public schools, theatres and churches on that day and shown on the screens in all moving picture houses, and to have a modern Paul Revere spread the alarm through old Middlesex County by aeroplane while church bells toll and factory whistles scream.

Aviation Recruiting Fast

Mineola.—Reports from the Signal Corps Aviation School at Mineola, Long Island, and other aerial training stations prove that the declaration of war has had an electric effect on the young men who are patriotic and wish to serve the colors. Heretofore there has never been a great number of applicants for aviation training, but if the record for applicants established last week keeps up it will be necessary for the Army and Navy officials to establish new schools. Heretofore the young man who was willing to do his share for the country chose some line other than flying. The aviation corps was looked upon as a body of men who did not care what became of themselves. Recent publicity has made an impression, however, and this, coupled with the fact that the greatest need of the hour is for aviators and flying machines to be used for coast patrol service, has caused a change. There is no other line of service that presents the opportunity for promotion as does the aerial branch. It affords an opportunity for the young American to do things of real valor, and, having done them, he may be sure of instant recognition.

American Philosophical Society Holds Aeronautic Session

The American Philosophical Society devoted the concluding afternoon of its series of conferences to the subject of aeronautics, many phases of which were covered by experts of prominence. The following was the program:

Dynamical Aspects: By Arthur Gordon Webster, Ph.D., LL.D., Member of Naval Advisory Board.

Physical Aspects: By Brigadier-General George O. Squier, Ph.D., Chief of Signal Corps, U. S. Army. (Introduced by Dr. Keen.)

Mechanical Aspects: By William Frederick Durand, Ph.D., Chairman of National Advisory Committee for Aeronautics. (Introduced by Dr. Walcott.)

Aerology in Aid of Aeronautics: By Charles F. Marvin, M.E., Chief of the United States Weather Bureau.

Mathematical Aspects: By Edwin Bidwell Wilson, Ph.D., Professor of Mathematics, Massachusetts Institute of Technology. (Introduced by Dr. E. W. Brown.)

Engineering Aspects: By Jerome C. Hunsaker, Eng. D., Assistant Naval Constructor, U. S. Navy. (Introduced by Dr. Bauer.)

Excellent Hall-Scott Record

A Hall-Scott A-70 90 h.p. four-cylinder engine, in a Martin model T. T. aeroplane at the Army School at San Diego, Cal., recently completed 102 hours and 39 minutes without being overhauled or taken out of the aeroplane, according to L. S. Scott, secretary of the Hall-Scott Motor Car Company.

Fowler to Form New Company

Robert Fowler, one of the organizers of the L. W. F. Engineering Co., is at the present time in California laying the foundations for a new aeroplane company, which will probably be located at Vallejo, Cal.

Yale Aviation Students Visit Curtiss Factory

Sixty Yale Senior Engineering students in charge of Prof. J. W. Roe, Prof. H. L. Seward, Mr. E. O. Waters and Mr. E. M. Wilcox, recently came all the way from New Haven to Buffalo to visit the Curtiss aeroplane factory and see applied in actual practice the theories which they had been studying.

At both Yale and Harvard large bodies of students have already signified their intention of entering the aviation corps, and several Harvard and Yale men are already in the training schools. Princeton is laying out a field which, it is expected, will soon be in active operation.

University of Michigan and the University of Illinois and many of the other Western colleges are equally interested, and it is said that over 5,000 requests for aviation training have been received by the Curtiss Company alone within the last two weeks.

Franklin K. Lane, Jr., Soon To Be Pilot

Franklin K. Lane, jr., son of the Secretary of the Interior in President Wilson's Cabinet, will soon finish his course of instruction in flying at the Government Aviation School at Newport News.

Ruth Law Back

Miss Ruth Law, the holder of the American Distance Record, returned from France last week, after spending several months in England and France, observing the latest methods of aerial warfare.

"I am at the service of my country for flying duty at any moment I may be called upon," she said.

"I am willing to fly a fast little scout machines alone, travelling 130 or 150 miles an hour, or I'll drive a heavier machine carrying a gun and gunner and go into actual battle with the enemy," added the diminutive holder of the Chicago-New York flight record. "That's what I'd like to do more than anything—get right into the fight.

"The only request I shall make of the Government when I offer my services formally, which will be in a day or so, is that I be sent to the front, wherever it is. Above all things, I'd like to go to the front in France, if America sends any soldiers over there.

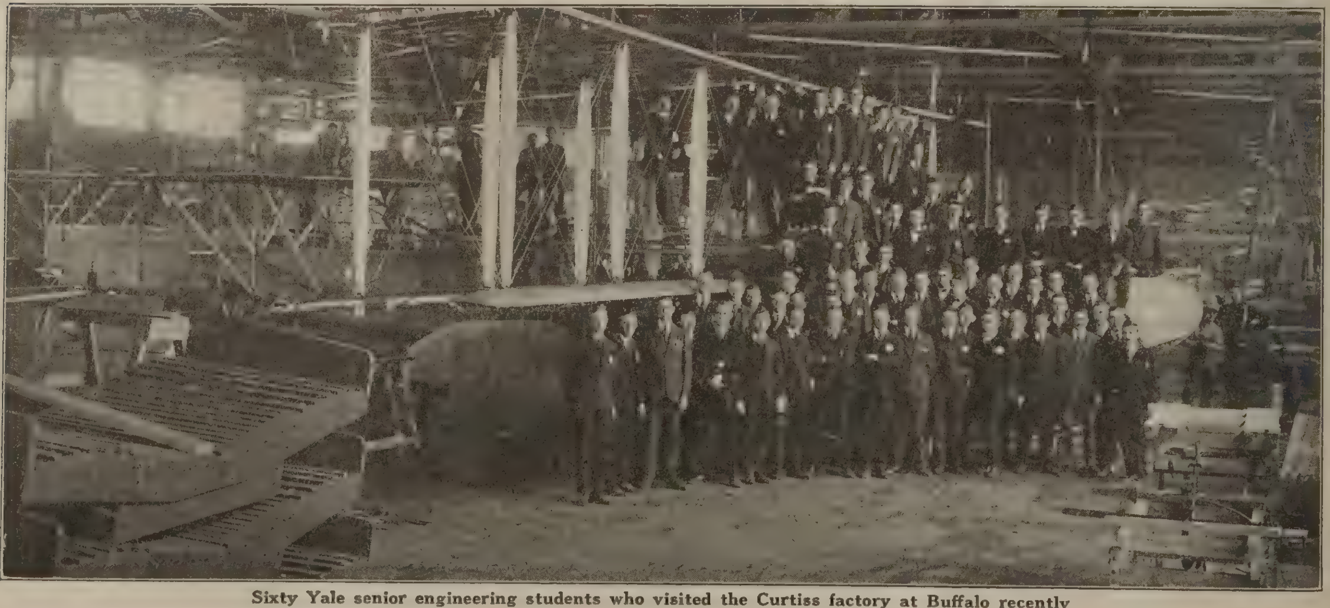
"If we have a woman Congressman, why can't we have a woman fighting aviator?" she demanded.

Miss Law tried to get to the fighting front, but was permitted no further than Compiegne, close to where the Germans were turned away from their march toward Paris early in the war.

"I met all the boys of the Lafayette Escadrille—the American flying group," she said, "and I had the privilege of chatting with the greatest fighting flyer of all, Lieut. Guynemer, who has shot down more than thirty flyers. He gave me a ring fashioned from the button of a German airman's coat."

"I saw a wonderful new bit of trick flying at Le Bourget," she went on. "It is a stunt called 'le vrille' (the gimlet). While the machine is on a level, the head stands still and then the tail whirls around and around. It is done by jamming the rudders. But, with all the fancy flying I saw, I still believe the best trick aviator I ever beheld was Lincoln Beachey, our own Yankee boy."

Miss Law brought back with her a French trench dog called Poilu, who saw much actual fighting and was wounded several times. He wears a miniature steel helmet. He had to go into quarantine because of the regulations regarding the importation of animals.



Sixty Yale senior engineering students who visited the Curtiss factory at Buffalo recently

Aviation Day at San Francisco

San Francisco: Preservation of the Column of Progress as a national memorial to aviators was taken over last night at the Palace Hotel by the Pacific Aero Club, and April 22 set as aviation day. A great public celebration will be held on that date to raise money to make permanent the famous monument on the Marina.

The committee in charge consists of J. C. Irvine, president of the Pacific Aero Club; Roy Francis, Lyman Doty and Frank Bryant, aviators, and E. T. McGettigan of Redwood City.

May Establish Aviation Co. in Arkansas

Little Rock, Ark.: Governor Brough of Arkansas has appointed Major W. H. Abington, of Beebe, surgeon of the First Infantry, as president; Capt. Berne F. Jungkind, of Beebe, surgeon of the First Infantry, and Capt. Glen M. Holmes, of Little Rock, assistant surgeon of the Second Infantry, as recorder, to constitute a board to examine applicants for the aviation service of the Arkansas National Guard.

Only members of the Guard will be eligible for the tests. Its purpose is to secure officers and men to take six months' training in some of the Government aviation schools. If a sufficient number can stand the tests and receive their Government licenses as pilots it is possible that an aviation corps may be authorized in Arkansas.

Candidates who pass the examination and are assigned to Government schools will be required to pay their own transportation and expenses to and from the schools, but will be on the pay of their rank while in attendance.

Examination for commissions in the Guard will be held at the Military Department next month.

Georgia Technology to Have Aviation School

Atlanta, Ga.—The trustees of the Georgia School of Technology, one of the largest and best known engineering schools in the South, have offered the school to the Government as a military training center for officers in the engineering reserve corps. The entire Tech. plant, with the full corps of instructors, is included in the offer.

In addition, it is proposed to establish an aviation school in connection with the school. It is probable that the flying field will be at Fort McPherson, while the technical instruction necessary to airmen will be given at the Tech. plant. Representatives of the institution have recently been in conference with General George O. Squier, chief signal officer of the United States Army, and Major General Leonard Wood. It is now believed that the Government will avail themselves of the offer within a few days. General Wood was at one time director of athletics at Georgia Tech., and is particularly interested in its present patriotism. The entire senior class, about a hundred men, has expressed its readiness to enter the army engineering corps.

Illinois Students Form Aero Corps

Champaign, Ill.—A students' aviation corps is to be the next addition to the military units of the University of Illinois. College soldiers who have aspirations to fly sent Prof. E. N. Fales, assistant professor mechanical engineering, to Washington to confer with army officers, and the new corps is the result.

Present plans include arrangements for actual flying training. After the student has become proficent and completes his course, he may become a lieutenant in the officers' reserve corps. The course to be arranged will include technical laboratory work and testing of aeronautic engines and propellers. So enthusiastic are the students over the new plan that a mass meeting is to be held soon at which volunteers for the new corps will be called for.

Physical Requirements of Aviators

"The advent of the aeroplane in modern military equipment has made it necessary to modify to some extent the method of physical examination of applicants," writes Dr. Charles P. Small in the Journal of the American Medical Association. "Because of the unusual and, until within a few years, the absolutely unknown conditions which the aviator must encounter, there must be a special standard of physical fitness, quite different in some respects from that required of men in other branches of military service. In time of peace the physical standard in all branches of the service should be maintained at the highest possible point. In time of war, when the need for all available fighting forces is urgent, the physical requirements of recruits might have to be considerably lowered. To lower the standard required of aviators, however, even in time of war, would be to incur the danger of most serious risks." He summarizes the optical requirements of a successful applicant for Army aviation service as: Uncorrected vision of 20/20 in each eye; binocular vision; absence of nystagmus; normal muscle balance and competent ocular muscles; normal pupillary reaction and no pupil irregularities when dilated; normal media and fundi; normal visual fields, by perimetric examination; normal color sense.

Princess Indita Rivola Hinodi Bennessee Meaning preparatory to flight in a Martin tractor at San Diego

Navy Buys Lewis Guns

As the result of a test held by the United States Marine Corps, at Winthrop, Md., on the corps' rifle range, Chief of the Bureau of Ordnance of the U. S. Navy Department, Admiral Ralph Earle, has placed an order for 2,000 Lewis machine guns, chambered for United States ammunition, with the Savage Arms Co., of Utica.

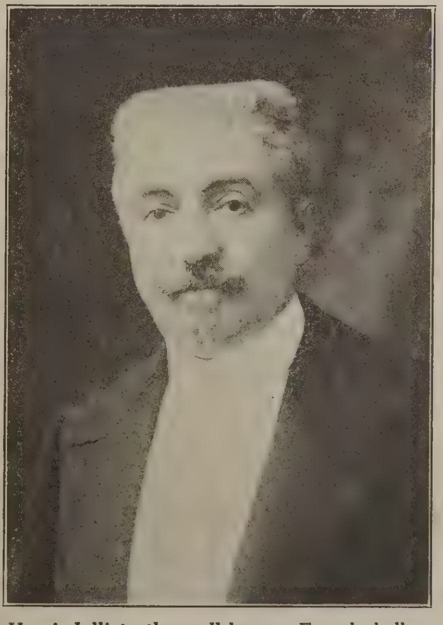
L. W. F. Co. Expands Plant

The L. W. F. Engineering Co., of College Point, has found it necessary to expand their factory space, and a new building is in course of erection. The plant is under guard of militiamen.

Searchlights Guard Aviation Field

Mineola, L. I.—As soon as news of the Belmont Park fire reached the military aviation camp here extra precautions were taken to guard the camp. All passes were revoked.

A half dozen searchlights have been installed and they will be played all over the grounds throughout the night. They will be placed on elevated positions which command every section of the grounds and hangars and be kept constantly in motion, making it impossible for any one to approach without being seen.



Henri Julliot, the well-known French balloon expert, who is in charge of the B. F. Goodrich aeronautical department

Army and Navy News

The fact that private insurance companies require aviators to surrender their policies when they begin making flights may compel the Government to enter the insurance business to a certain degree. Next to the lack of machines, it is understood that this question of inadequate protection for the dependents of the flyer is the biggest obstacle met by the Army and Navy officers who are working to complete the Aviation Corps of the Services. The lack of machines is expected to be remedied as soon as the plans discussed at recent conferences have been put into operation.

Plans for the organization of an aviation company of marines have been completed and now only wait the training of the personnel, a portion of which is already at the naval aeronautical station at Pensacola, Fla. With the equipment which has been gathered at the Philadelphia advance base depot is included a three-ton truck of the "F. W. D." type, equipped with a complete machine shop for making repairs to aeroplanes. This truck is similar to that adopted by the Signal Corps and Quartermasters Corps for the same work. Tentative proposals for two more of the same type have been asked from the concern which makes them for the marines' aviation company.

Capt. Reynold C. Bolling, S.O.R.C., in civil life a solicitor for the U. S. Steel Company, has offered to recruit and equip the personnel for one complete air squadron to be attached to the Signal Corps of the Army. Capt. Bolling's plans have progressed to the point where the War Department has opened negotiations for a lease of a suitable field outside New York to be used as a training ground for the squadron. The aeroplanes and other equipment will be furnished by the Government if the offer is accepted, this being necessary in view of the promise voluntarily made by each of the twelve firms making aeroplanes to accept no private contracts until the wants of the War Department had been met.

Lieut. Harold S. Martin, Signal Corps, U. S. A., who has been taking a special course in aeronautical engineering at the Massachusetts Institute of Technology, has been ordered to the aviation school at Mineola, L. I. Capt. Charles DeF. Chandler, U. S. A., who has been in charge of the Army Balloon School at Fort Omaha Neb., will be ordered to Washington soon. Captain Chandler's experience and training as a balloon expert will be utilized at headquarters.

Capt. Edgar S. Gorrell, junior military aviator, S. C., from duty at the Massachusetts Institute of Technology, Cambridge, Mass., to Washington and report in person to Chief Signal Officer of the Army for duty in his office. (March 30, War D.)

Capt. Harold S. Martin, S. C., from duty at the Massachusetts Institute of Technology, Boston, Mass., and to Mineola, Long Island, N. Y., Aviation Station, for duty. (March 29, War D.)

First Lieut. Harold M. Gallop, Aviation Section, S. O. R. C., to active duty at Fort Sam Houston, Texas, with 3d Aero Squadron for duty. (March 30, War D.)

First Lieut. William G. Schauffler, Jr., Aviation Section, S. O. R. C., is assigned to active duty and will proceed to Fort Sam Houston for duty with 3d Aero Squadron. (April 2, War D.)

Sergt. Harry M. McCuiston, S. E. R. C., from active duty at Curtiss Aviation School, Newport News, Va., April 5, to home. (April 3, War D.)

Sergts. Chester E. Wright and Howard C. Smith, S. E. R. C., Fort Monroe, Va., to active duty at Curtiss Aviation School, Newport News, Va., April 3. (April 3, War D.)

Sergt. Roderick H. Jones, S. E. R. C., from active duty at Curtiss Aviation School, Newport News, Va., April 5, to home. (April 3, War D.)

Sergt. William N. De Wald, S. E. R. C., Fort Slocum, N. Y., to active duty at the Curtiss Aviation School, Miami, Fla., April 1, 1917. (March 28, War D.)

Sergts. Bernard A. Law and Alfred R. Metzgar, Jr., S. E. R. C., now at Fort Monroe, Va., are assigned to active duty in Aviation Section of Signal Enlisted Reserve Corps, with station at the Curtiss Aviation School, Newport News, Va., April 1. (March 29, War D.)

Sergts. Rutledge B. Barry and Wallace D. Culbertson, S. E. R. C., now at Key West Barracks, Fla., are assigned to active duty in the Aviation Section of the S. E. R. C., with station at the Curtiss Aviation School, Miami, Fla., to take effect April 1, 1917. (March 29, War D.)

Sergt. John M. Foote, S. E. R. C., Memphis, Tenn., to active duty, with station at the Signal Corps Aviation School, Memphis, April 1. (March 30, War D.)

Sergt. John G. Colgan, S. E. R. C., from active duty at Curtiss Aviation School, Newport News, Va., to home. (March 31, War D.)

Summer Meeting of Automotive Engineers

The annual Summer Meeting of the Society of Automotive Engineers will be held Tuesday, Wednesday, Thursday and Friday, the last week in June, at Ottawa Beach Hotel on Lake Michigan. Ottawa Beach is located on the east shore of Lake Michigan approximately 100 miles across the lake from Chicago.

For the last three years the Society of Automobile Engineers has held its summer convention on a steamboat on Lake Huron, but not many months ago the council of the society decided that owing to its amalgamating with aviation engineers, farm tractor engineers, motor boat engineers, etc., that the convention this year should be held at some point where it would be possible to have demonstrations of aeroplanes and hydroplanes. Ottawa Beach is ideally suited for such in that it is at a point where Black Lake connects through a narrow channel with Lake Michigan. Black Lake is a small body of water six miles in diameter and ideal for hydroplane work. It is also ideal for motor boat work.

It may be possible to have an aeroplane or hydroplane daily mail service from Chicago to Ottawa Beach during the four days of the convention.

Another reason for holding the convention at some such exclusive hotel center as Ottawa Beach is that it will permit of several divisions of the society meeting at one time, which was not possible on the steamboat. For example on one day it may be possible that aeroplane engineers will be discussing some feature of plane construction or trussing; farm tractor engineers may be discussing wheels, speeds, etc.; motor boat engineers may be discussing standardizing boat dimensions, etc.; and automobile and motor boat engineers discussing questions local to their vehicles. This programme can be perfectly carried out at this beach.

On other days when questions of motor, balance, ignition, lubrication, testing, etc., are under consideration, all departments can meet in one group.

It is possible that the forenoons will be given over to professional work and the evenings to recreation. Each afternoon there will be some short illustrated engineering lecture and there will be many special moving picture films of an engineering nature.

Memorial Services for J. R. McConnell

Carthage, N C.—A memorial service was held in the court-house, April 1st, for the late Sargeant McConnell, of the American Flying Corps, with the French Army. Messages were read from many persons of prominence, including the Governor of North Carolina, the French Ambassador, and the parents of Victor Chapman, and Kiffin Rockwell, aviators who also gave up their lives for France.

Alexander Graham Bell Honored

Dr. Alexander Graham Bell, inventor of the telephone, and a great friend of aviation, was presented with the Civic Forum Medal of Honor for Distinguished Public Service in New York City on March 22. Among the prominent speakers of the evening was Rear-Admiral Robert E. Peary.

Will Build Aeroplanes on the Cape

Portland, Me.—An aeroplane factory of large proportions is to be erected within a few weeks in the shipyards of Captain Philip H. Doyen on Cottage Road and arrangements for the erection of the structure are well under way at the present time. The output will be delivered to the Italian Government.

This new industry will mean the employment of a large amount of help and the work of manufacturing the air craft in the proposed new factory will mean a decided stimulus to South Portland business.

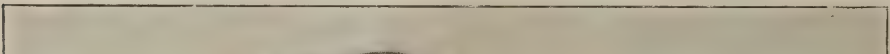
Personal Pars

Mr. Arthur M. Johnson, of 308 Renova Street, Hazelwood, Pa., has invented a type of aeroplane with which he expects to beat all speed records, and in the large size, carry 22 men, and be a terror in air battles.

An airship invented by Charles Hunsicker, 220 Northwestern Avenue, Dayton, Ohio, is exciting considerable interest among those who have seen the machine and had its principles explained. Those to whom the inventor has exhibited his work have pronounced it practical and Mr. Hunsicker is planning soon to place it before the Greater Dayton Association Inventions Committee for approval and financial assistance.

Westfield, N. J.—Russell G. Clotworthy, aged 18 years, and Francis McAllister, aged 19 years, have enlisted in the Aviation Corps and are now at Fort Slocum, where they will receive training before starting for the West. The two boys quietly planned to enter the service of Uncle Sam as birdmen, and when they left their home for business one morning recently they failed to return at night, but instead left a note on Mr. McAllister's desk in New York, in which they said they had enlisted.

Irah D. Spaulding, of Brattleboro, Vt., has been appointed First Lieutenant in the United States Aviation Corps. He has been assigned to Fort Wood, N. Y., for a short course before going to San Diego, Cal., as instructor in the Curtiss School. He won his license at the Curtiss School in 1912 at the age of 19, being at that time the youngest licensed aviator in the United States. He has made several flights in this locality. Three years ago he married Miss Louise Cherrie, of Newfane, daughter of Prof. George K. Cherrie, the naturalist, who accompanied Col. Roosevelt on his South American trip of exploration.



A unique test was made recently with a Martin tractor, when an Indian motorcycle was lashed to the fusilage and the cycle and its rider successfully transported through the air. The test was arranged by Glenn L. Martin to demonstrate a new phase of the aeroplane's military usefulness

Curtiss Plant to Run 7 Days a Week

Albany, N. Y.—The State Industrial Commission has given permission to the Curtiss Aeroplane Company, of Buffalo, to operate its plant continuously for seven days a week, exempting the company from the provisions of the "one day of rest in seven" law during the present war emergency.

"The company," says a statement issued by the commission, "sets forth that the United States Government was insistent upon a large number of aeroplanes as soon as possible and that this could not be done unless the plant was operated continuously."

Members of the commission declared that they would do everything in their power to facilitate the speedy manufacture and delivery of munitions, aeroplanes, submarines and all other supplies needed by the Government "in the war emergency now confronting the country."

They, however, are opposed to the Johnson bill, directing that the provisions of the labor law, limiting the hours of labor of minors and women, shall not apply to the employment of persons over sixteen years of age in the manufacture of military supplies for the United States or any State. On the advice of the Industrial Commission the measure has been killed by the Assembly Labor and Industries Committee. It is held that to enact such a provision would break down the safeguards in the labor law and the commission has authority now to make proper variations.

Rhode Island Aviation Corps Needs More Men

Providence, R. I.—Need of men in a newly organized section of the aeroplane division of the Rhode Island Naval Militia has been announced by officers of this unit of America's defenders and that applicants for admission to the service will be received at the State Armory. It is explained that the physical examination is rigid but that the opportunities are excellent. Applicants must be 18 years or over and American citizens. One division of this service has already been filled and the new one, it is expected, will soon have its completement.

Several men have already enlisted for air service for three years as national naval volunteers, but there is yet room for about 16 more men, needed to complete the division, which at war strength, should total 56 men and officers.

At the present time two officers and four men of the division are in Pensacola, Fla., receiving three months instruction' in the operation of aeroplanes. The same number have just completed a similar tour of service.

French May Send Aviation Instructors

Paris.—Plans are being made with a view to offering to send a French aero mission to the United States when hostilities between that country and Germany begin. It will consist of a number of superior pilots, observers and gunners to serve as instructors in the American army and navy. As in the case of other French air missions to the allied nations, volunteers will be called for, but preference will be given to American or English speaking pilots of a certain amount of experience and proved ability.

Several of the crack French airmen have already applied to the director of aviation for service on this mission, and undoubtedly there will be many more when the time comes.

Army and Navy News

Following is a list of the personnel under training at the Memphis Government Aviation Station:

Capt. Joseph C. Morrow, Signal Corps, Officer in Charge.

Capt. Arthur R. Christie, Officer in Charge of Training.

First Lieut. William R. Van Sant, Supply Officer.

First Lieut. William W. Spain, South Dakota National Guard (Student).

Albert C. Adams, Frank W. Alsip, Charles W. Browne, George F. Fisher, John M. Foot, Austin E. Gibson, Reuben H. Harper, Samuel A. Herrick, Percy N. Hollowell, Eugene B. Jones, George J. Kinberg, George E. Knight, Earl E. Leonard, Donald Lyle, Alexander McLeod, Fletcher L. McCordic, Arthur Mitchell, Andrew C. Ortmayer, Harry W. Powers, Carlyle Rhodes, Harold M. Sanford, George J. Sawyer, Rudolph W. Schroeder, Carlos B. Stevens, Thorn C. Taylor, William A. Thompson, Joseph Van Walchshauser, Orrin E. Wolf.

Sergeants Michael L. Gerlowski, Grant C. Melvin and Victor J. Picard; selected cilivian mechanicians, Robert H. Houser, Joseph Pallisard, Julian Sykes and Wilfred G. Threader.

Charles Chester, Sergeant first class. Sergeant Roy R. Showalter and William F. Jones, private first class.

There are nine aeroplanes in commission at the station.

Aeronautic Plans of the B. F. Goodrich Co.

Henri Julliot, the prominent French engineer and builder of dirigibles, although he arrived in this country but several weeks ago, is already deep in the work of constructing the two huge Blimp type non-rigid diriigble balloons which are being built for the Government by The B. F. Goodrich Rubber Company, where he has accepted the commission as chief of the Goodrich Aeronautical Division.

It was not until two years ago, following a visit to the Goodrich factories here in America, that Julliot saw the possibilities of his dirigibles in their adaptation to military use by the United States Government. With the foresight and determination so characteristic of his people he returned to France, where he lived practically the past two years in observing all types of aircraft and the success with which they were used by the Allied Governments. He also acted in an advisory capacity to the French Government during this period.

The present order for two of the Blimp type non-rigid dirigibles is being supplied under the personal direction of M. Julliot. This was the total number recently bid upon by The Goodrich Company, but now with the complete organization with which M. Julliot has surrounded himself, the facilities will permit of larger numbers being built in the near future in accordance with the aceptance of the offer of the entire Goodrich resources by the United States Government.

Domenjoz in Europe

New York City.—Mr. G. J. Kluyskens, well-known importer of Gnome and Anzani aviation engines, has recently received a letter from Jean Domenjoz, the famous exhibition pilot. Mr. Domenjoz is now with Bleriot in Buc, where he is in charge of reception and testing of the new Spads, which are equipped with 140 h.p. 8-cyl. V-type, two-cycle "Hispano Suise" motors.

The Spad is a small biplane of only 18 meters bearing surface and weighs 1,650 lbs., without gun, gasoline, pilot and oil. The speed is from 200 to 214 kilometers per hour. Mr. Domenjoz says that it is fearsome the way the machines climb; they climb at the rate of 3,000 metres in four to four and one-half minutes. Bleriot is now turning out five a day of these Spads, and the Spad people themselves turn out three a day.

He further advises that the Nieuport biplane is also giving very good satisfaction. Morane and Vedrine are also bringing out new machines and are now making tests with experimental machines.

Mr. Domenjoz also writes that the cost of living has gone up at least 50 per cent since he was last in Paris.

Mr. Domenjoz has a contract with Bleriot up to the end of May, and he will take the first boat in June to fill his flying engagements in this country.

Judgment Filed Against Aeronautical Society For $163.41

The New York Times, April 7th, publishes the following judgment filed in New York County, the first name being that of the debtor:

Aeronautical Society of America, Inc.—R. A. Chesebraugh, $163.41.

Personal Pars

Mrs. Lewis F. Burrough of Hastings, New York, has announced the engagement of her cousin, Miss Grace H. Oakey, to Robert M. Olyphant, Jr., son of Robert Olyphant of New York City. Mr. Olyphant is a member of the Aero Club of America and the First Flying Corps of New York.

HERDING SHEEP BY AEROPLANE

By JOHN E. HOGG

HERDING sheep from an aeroplane, scouting for lost herds, and signaling to herders and cowboys with smoke bombs and wireless is the latest use for the heavier-than-air vehicle evolved by J. Stanley Smith, a millionaire sheep ranchman, of Martinsdale, Meagher County, Montana.

Mr. Smith has purchased a plane, a 150 h.p. Martin tractor, and has enrolled for a course in aviation in the Gleen L. Martin school at Los Angeles. With the completion of his training he proposed to return to his estate in Montana, where he will inaugurate the use of aircraft in connection with the sheep raising industry.

"It takes a man on horseback four days to ride from one side of my ranch to the other," said Mr. Smith, in commenting upon his novel idea. "Hundreds of my sheep have been lost on the range, and have never been found by the herders. They died later from exposure and lack of attention. Last year I lost some 2,000 sheep. This loss I propose to eliminate by the use of an aeroplane.

"How I will do it is the simplest thing in the world. By flying over the wild portions of my estate it will be an easy matter to observe every herd of sheep from a comparatively low elevation. Sheep always go in herds, you know, seldom less than two or three hundred in a herd. When I sight a herd from the air, I will simply drop a smoke bomb, which will serve to indicate their location to the herders and men in the pack trains. I shall also have my machine equipped with wireless, which will enable me to communicate with the wireless station that will be installed on one of the motor truck of the pack train. In this way it will be possible for me to give definite instructions to my men as to the location of the lost herds, and for their getting to them by the most direct route.

"From the financial viewpoint the use of the aerial patrol on sheep ranches will result in an enormous saving. If I am only able to save half of the sheep that I have lost in former years the plan will pay for itself with big dividends thrown in.

"I will take this one plane back to Montana with me to give the plan a tryout, and if it works out, as I have every reason to believe that it will. I shall purchase at least five more planes for my ranch. Other sheep men in my vicinity have their eyes on the feasibility of the aerial patrol, and the success of the project will mean the universal adoption of the aeroplane by all the large sheep ranchers of the northwest."

Farmer Smith and his Martin tractor biplane in which he herds his sheep as described above

AMERICAN BATTLEPLANES

REAR ADMIRAL FISKE, whose inventions and achievements rank him with the leading naval authorities of the world, recently gave it as his opinion that one hundred large battleplanes carrying 3-inch guns would afford the defensive power of about 60,000 rifles.

In the memorandum Admiral Fiske pointed out that:

"If battleplanes have a field of usefulness in Europe, where the distances are very small and where the organization, training and strategical employment of large armies have reached a high state of development, do they not have a much wider field in the United States, where the distances are relatively enormous, and where the organization, training and strategical employment of large armies are arts almost unknown? Is it not possible that an immediate and strenuous development of battleplanes might save us from invasion, just as the Monitor saved us from the Merrimac?

"In case our fleet is defeated in the Atlantic during the next year, we shall not have an army that could not stand up against any European army that might land on our shores. But if we had a division of say one hundred battleplanes near New York, costing about three million dollars, we could certainly prevent the disembarkment, transit in boats to the shore, and landing of any force of soldiers, especially if the battleplanes were assisted by say two hundred small aeroplanes, dropping bombs. Similar divisions at other points, including one at the Panama Canal, could perform similar services, and the great speed of the aircraft would enable each division to guard a long extent of coast. A division of 100 battleplanes could go from New York to the Capes of the Chesapeake in three or four hours. They could be equipped with 3-inch guns. The muzzle energy of 100 3-inch guns is equal to the muzzle energy (and therefore destructive power) of about 60,000 soldiers' rifles.

"The size and power of the aeroplanes has already gone far beyond the limits set for its possible development by certain engineers only three years ago. The practical difficulties of making it larger still are quite apparent; yet, nevertheless, no theoretical limits to its size and power have yet been accepted by aeronauts. That the aeroplane is now the best single weapon against the submarine is conceded. That the aeroplane, and especially the battleplane, will rapidly advance is size and power within the coming year and afterwards, is the mature belief of many aeronauts; should we not therefore immediately investigate its capabilities, not only as a scout and accessory, but as a major instrument of warfare?

"I do not suggest the abolition of the soldier and his musket; but neither do I suggest the abolition of the boat pulled by the oars of rowers. I merely suggest that, as the boat pulled by rowers was superseded for large operations by the sailing ships, and as the sailing ship was superseded by the more mobile steamer with broadside guns; and as this type of warship has been superseded by the turret ships, and as the turret ship has been expanded into a super-dreadnought, so the soldier and his musket may be superseded for important operations by the immeasurably more powerful and mobile battleplane.

"If so, the more quickly we act, the better. 'Hindenburg never sleeps.' "

Those familiar with the activities of the multiple-motored machines in Europe—the Handley-Page, The German Fritz, the Italian Caproni, the various French "avion de chasse," and the Russian Sikorsky—know the effective service they have rendered, and relatively speaking they are just beginning to be used.

In the last two issues, AERIAL AGE has presented an article by F. Handley-Page, which ably sets forth "The Case for the Large Aeroplane," and the purpose of the present article is to present the facts concerning some of the leading twin-motored American machines.

The Curtiss Twin JN

Amongst the first successfully flown twin-motored machines, was the Curtiss JN military tractor, in which Victor Carlstrom, carrying Mr. Alan R. Hawley, president of the Aero Club of America, as passenger, made a flight from New York to Washington.

The Curtiss Model JN Twin-motored Tractor possesses all the inherent advantages which go to make up a successful military aeroplane. It has high maximum speed and fast climbing ability combined with a slow landing speed and great weight carrying capacity. Although it weighs but 2,110 pounds, empty, it has a useful load carrying capacity of 1,040 pounds.

Two Curtiss Model OXX 8-cylinder motors, one located to the left and the other to the right of the fuselage, give this battleplane an available 200 horsepower.

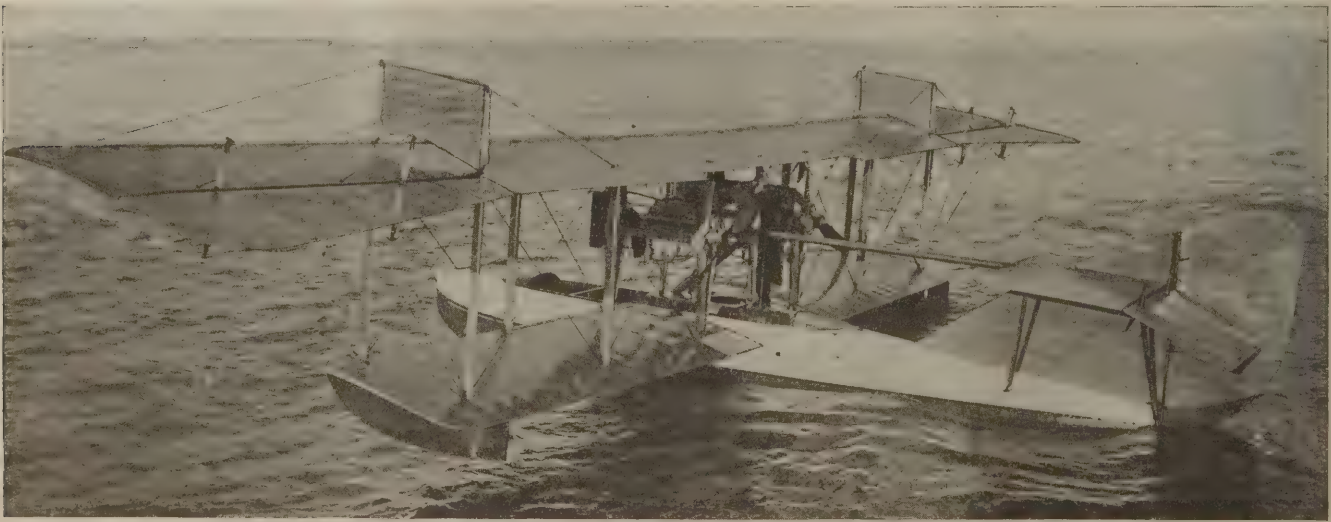
It has a maximum horizontal flight speed of 85 miles per hour, a minimum of 48 miles per hour, and a climbing speed under normal conditions, of 4,000 feet in 10 minutes. The machine will fly and climb on one motor.

The front cockpit is placed in the nose of the fuselage, giving to the observer or gunner seated therein an unobstructed range of vision and an extensive field of fire.

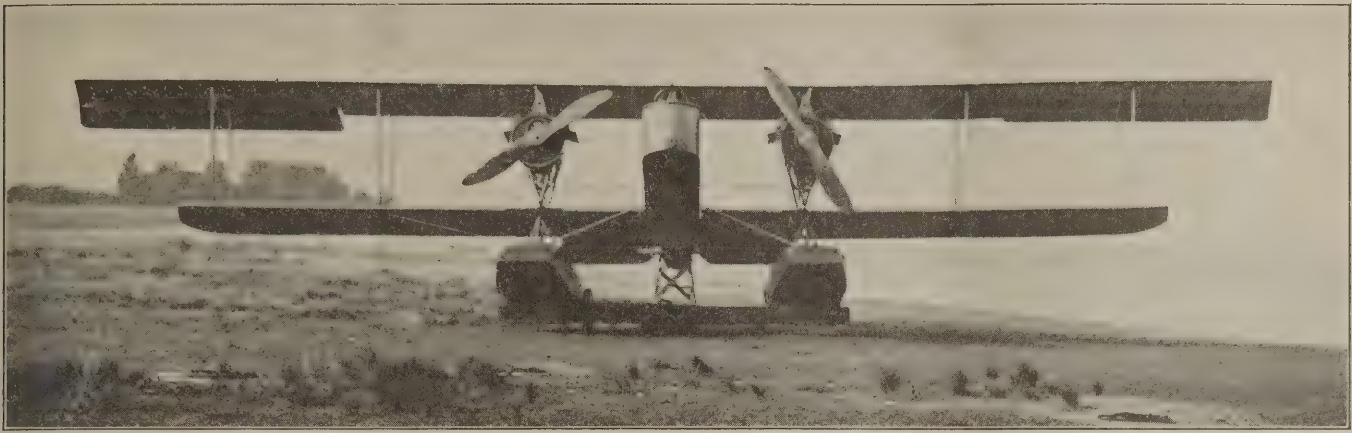
The twin-motored machine possesses several advantages over the single-motored type. The two propellers, turning clockwise and counter-clockwise, respectively, result in equalized torque and gyroscopic effects. The air streams which they produce also have a tendency to make the machine readily controllable under power. Without power, this machine assumes a moderate gliding angle which permits an easy and safe landing.

Another advantage gained by the use of two motors is a decrease, relatively, in the air resistance to the progress of the aeroplane through it. Because there is a smaller, total projected area of the machine lying in the propeller "slip streams" less power is consumed in overcoming head resistance and the surplus thus saved can be utilized for increasing speed or useful load carrying capacity.

By using twin motors it is also possible to equip with greater power without resorting to excessive propeller sizes and speeds.



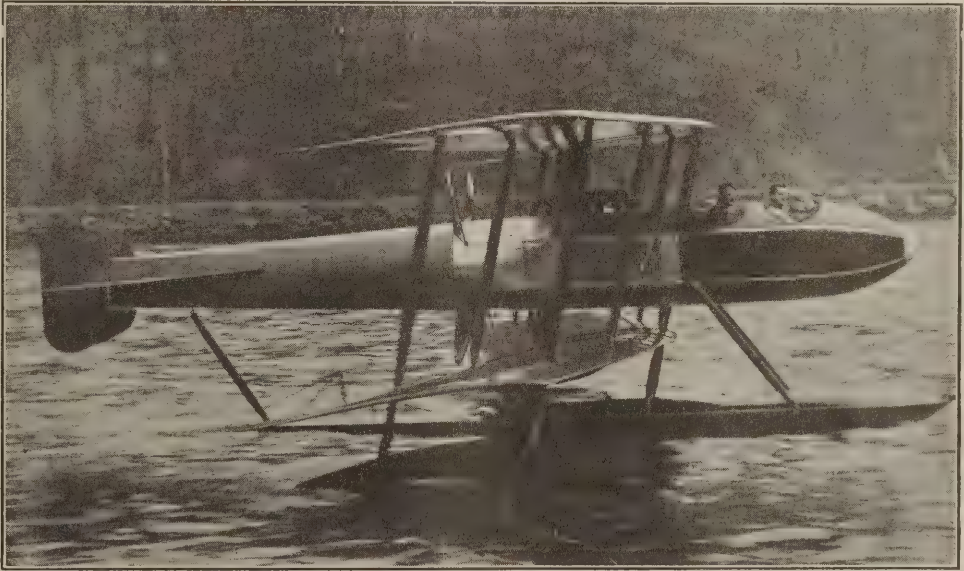
The five-passenger Curtiss cruiser of the America Trans-Oceanic Co., at Port Washington, L. I.



The twin-motored Curtiss Hydroaeroplane. Two 100 H.P. motors are used

Curtiss "Canada" Type

The "Canada" was a development of the Toronto Curtiss plant. A tractor biplane with two Curtiss OX2 motors, a span of 76 feet and a length from nose to tail of 28 feet. The length of the fuselage is 17 feet, and 32 inches wide. The machine was designed to carry two observers and pilot.



Gallaudet Seaplane constructed for the U. S. Navy, and equipped with two Duesenberg aviation motors

The "America"

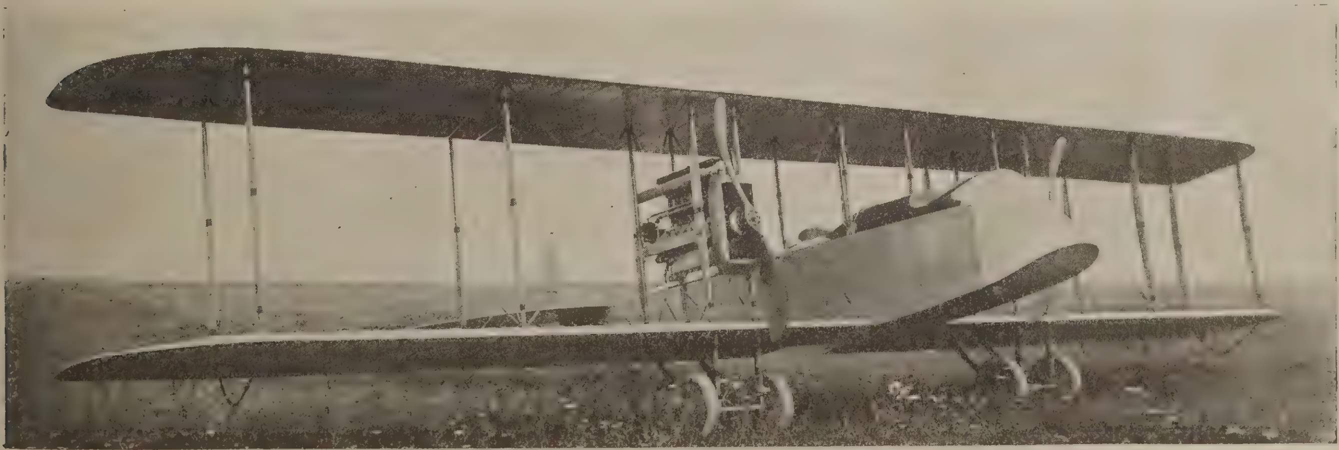
The "America" was the first twin-motored flying boat to be built by the Curtiss Company. It was constructed for Rodman Wanamaker in connection with his plans to cross the Atlantic in an aeroplane. The outbreak of the war upset the scheme, and the machine was sold to the British Admirality.

It had two 100 h.p. Curtiss motors, and could accommodate four men comfortably in its cabin.

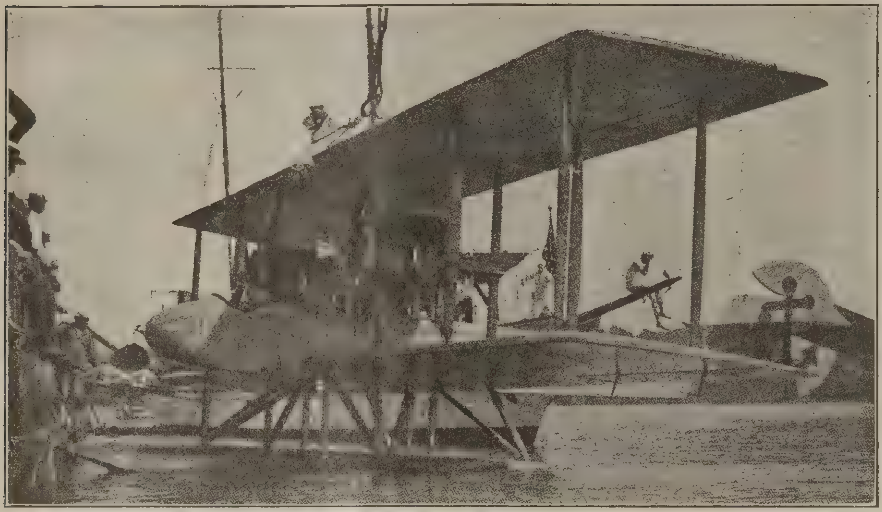
The "Super-America" Types

Containing every instrument and device that makes for comfort and safety, the Curtiss "Flying Cruiser" of the Super-America type is not only one of the best equipped flying boats in the world, but is the largest and most finely finished boat flown in America. First trials were made by David H. McCulloch, chief pilot of the America Trans-Oceanic Co., at Port Washington, L. I., in the early part of November. The machine handled beautifully, and gave its owners reason to believe it would fulfill the requirements for which it was designed.

Electric starters are provided for the motors. Automatic stability is obtained by the use of the Sperry Gyroscope, operated by Servo motors which are run by air fans.



Atlantic aircraft battleplane designed by A. S. Heinrich, and powered with two Aeromarine motors



Twin-motor hydroaeroplane constructed by the U. S. Navy

A large searchlight is located at the nose of the hull. There are dash lights, cockpit lights, rear seat lights, tail lights and red and green port and starboard lights on upper wing tips. Small lights are located at the top of all interplane struts, which cast their rays downward and along all wires, making the machine quite visible at night, facilitating landing and permitting the observation of all structural members while in flight. A "trouble light" on an extensionable lead is carried in the mechanic's cockpit, for use in making adjustments or repairs.

Generators for supplying the current necessary for the operation of the gyroscopes, lights and instruments, are fastened on the outrigger where their wind turbines are near the slip stream of the propellers. Each generator is of 55-watt capacity, producing 2 amperes at 22 volts when driven at 4,000 r.p.m. To avoid the possibility of damaging the gyroscopes by an excessive current as well as to provide current for the instruments, a storage battery is placed on the circuit. The battery is of 2 ampere hours capacity. The weight of the entire electric generating installation is under 70 pounds.

The supporting surface includes the upper and lower wings, the total area of which is 853.16 square feet. The aeroplane (dead load) weighs 2,240.10 pounds. Power plant and accessories (dead load), 1,316.50 pounds. Live load, consisting of passenger and pilot (330 pounds), fuel (558 pounds), oil (62 pounds), and the additional required load (150 pounds) totals up to 1,100 pounds. Grand total weight of aeroplane, power plant, accessories and live load, 4,656.60 pounds.

Loading calculated at 4,656.60 (divided by 853.16), which equals 5.46 per square foot. Load lifted per rated h.p. (4,656.60 divided by 200, equals ——) 23.28 pounds per r.h.p. Load lifted per brake h.p. (4,656.60 divided by 216, equals ——) 21.60 pounds per b.h.p.

General Dimensions: Planes, upper, 75 feet, 10 inches; Planes, lower, 48 feet; Chord, 7 feet; Gap, 7 feet, 6 inches; Length, overall, 39 feet; Net weight, 3,556 pounds; Weight, fully loaded, 4,656 pounds; Motors (2) Curtiss, 100 h.p., 200 h.p.; Speed range, 65-48 m.p.h.; Climb in 10 minutes, 2,000 feet.

The Curtiss H-12

The Model H-12 flying boat, built by the Curtiss Co., for the U. S. Navy, is the largest type of flying boat in the world. First trials are to be given it at Pensacola, Fla. Although the H-12s have been turned out in large numbers for use in European navies, the demonstration flights at Pensacola will be the first to have been made by such a machine in this country.

In spite of the gigantic proportions of the boat, it is easily controlled by one pilot. Four or five passengers besides the pilot can comfortably move about in the cockpit. The cockpit is entirely covered over by a hatch provided with celluloid windows permitting vision in all directions. This not only protects the occupants from the wind when in flight and spray when alighting, but also carries out the smooth effect of the hull to decrease wind resistance and skin friction.

Curtiss model twin J. N. Military Tractor

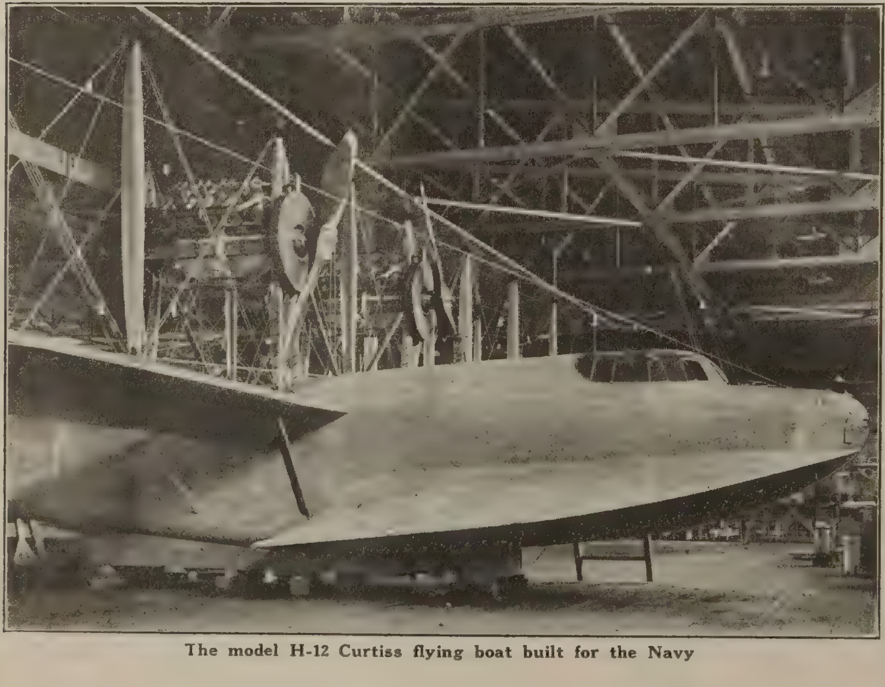
List of general dimensions, areas and weights: Wing span, upper plane, 92 feet, 8½ inches; Wing span, lower plane, 66 feet, 11½ inches; Total supporting surface, 1120.78 square feet; Gap between wings, 8 feet; Height overall, 16 feet, 9¼ inches; Net weight of machine, empty, 5,945 pounds; Useful load (as listed below), 2.044 pounds; Motors (2) each 200 h.p., 400 h.p.

Useful load is figured as being composed of pilot and passengers each weighing 170 pounds; oil, 148 pounds, and gasoline, 1,556 pounds. In shorter flights the quantity of oil and fuel can be decreased and passengers carried of equal weight.

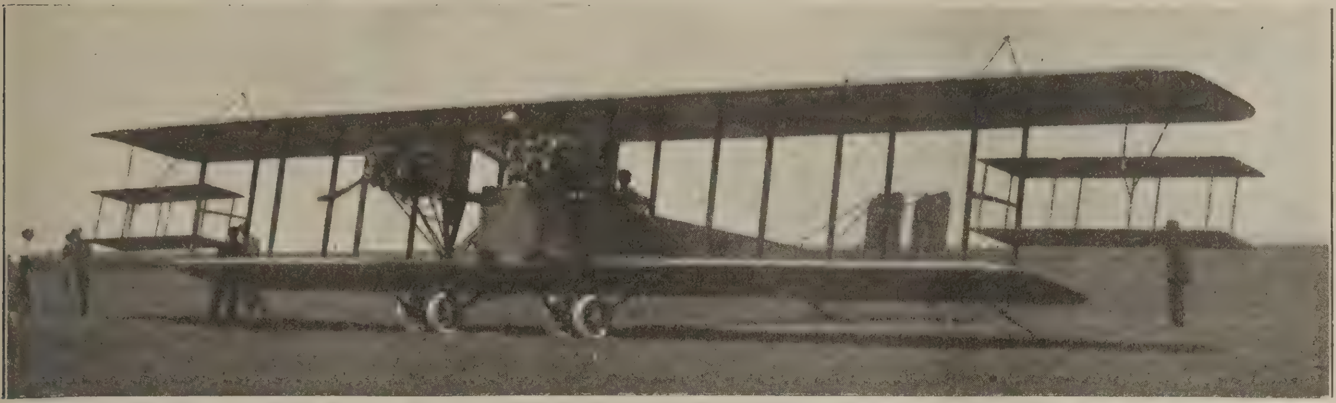
Twin motors of the Curtiss Model V2 are supported between the planes with the propellers in tractor position. Forward of the motor-carrying struts the circular radiators are located, through which the propeller shaft project. The V2 motor is an eight-cylinder V-type, four-stroke cycle, rated at 200 h.p. at 1,400 r.p.m.. Bore, 5 inches; stroke, 7 inches. Ignition is by two high-tension eight-cylinder magnetos and cooling by water circulated by a centrifugal pump. Two Zenith carbureters.

Gasoline consumption per b.h.p. hour, .54 pound; oil, .03 pound. Weight of each motor with propeller hub, but without oil or water, 690 pounds. Dead weight per rated h.p., 3.45 pounds.

The boat is expected to attain a speed of eighty-five miles an hour, and leaves the water at approximately fifty-five miles an hour.



The model H-12 Curtiss flying boat built for the Navy



The twin-motored Andermat Cruiser Aeroplane which has a wing-spread of 72 feet

The N. Y. Aero Construction Seaplane

The hydroaeroplane recently completed and tested by the N. Y. Aeroplane Construction Co., has a supporting surface of 820 square feet, twin Aeromarine motors, 100 h.p. each, and twin pontoons, weighs 2,700 pounds, and has room for a useful load of 1,700 pounds. Its maximum speed is 85 miles per hour, minimum, 43 miles per hour, and it has a flying radius of nine hours. Due to advanced type of pontoons and other features embodied in the plane, it rose from the water on test within fifty feet, Aviator W. Leonard Bonney flying. The pontoons can be replaced by land rigging.

The plane was designed and constructed under the supervision of Mr. Warren S. Eaton, who is a poineer in the aviation business, having designed and constructed planes for the Glenn L. Martin Co., of Los Angeles. He also designed and built four of the most efficient planes for Lincoln Beachy, which had their demonstration before people in the West.

The Twin-Motored Atlantic Tractor

The twin-motored tractor designed by Albert S. Heinrich, of the Atlantic Aircraft Co., made successful flights at Mineola, in the Summer of 1916, when aerial topedo carrying tests were made. The power plants were two Aeromarine six-cylinder motors.

As the fuselage projects well forward of the planes, a machine gun mounted on the nose is permitted a wide arc of fire. One of the tests at Mineola consisted of carrying a torpedo below the fuselage, which could be released at the will of the observer. The nature of the landing gear gives a good deal of clear space below the fuselage, affording an ideal location for suspending and releasing aerial torpedoes of large size.

General Dimensions: Top and bottom span, 48 feet; chord, 6 feet; gap, 7 feet; length overall, 28 feet, 6 inches; height, 11 feet; area, main planes, 550 square feet; area, stabilizer and elevators, 60 square feet; motors (2), 92 h.p. each, 184 h.p.

The Andermat Cruiser

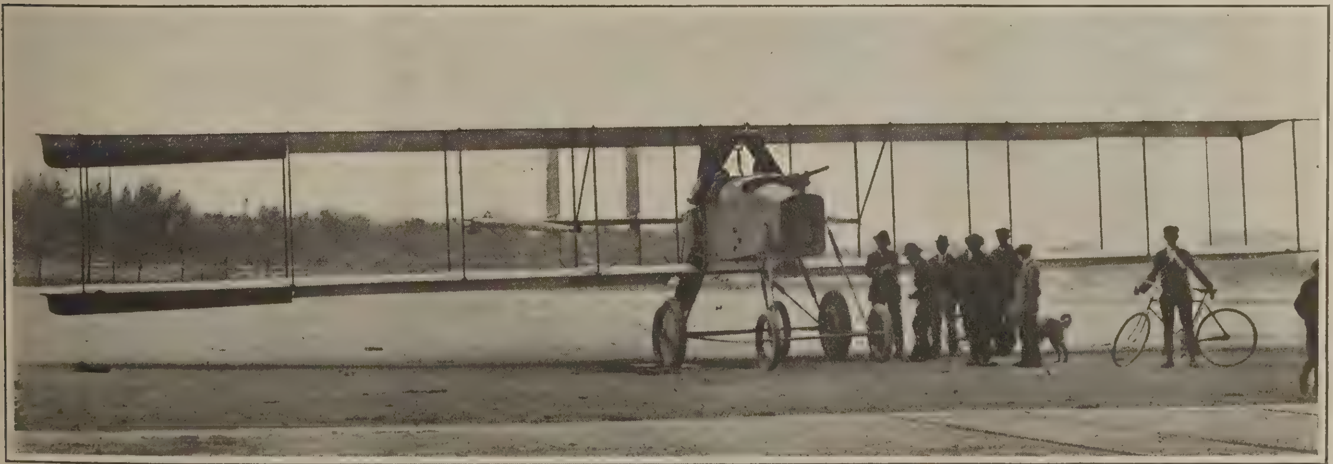
The Andermat cruiser, a twin-motored battleplane, was constructed at Sunnyvale, California, under the direction of W. G. Loomis. It has a wing spread of 72 feet and a length of 35 feet from nose to tip of the tail. The power plants are two 120 h.p. Andermat engines. The first machine constructed was flown successfully, and it is stated that plans are now under way for the organization of a large company to produce the machine in quantity.

The Gallaudet Seaplane

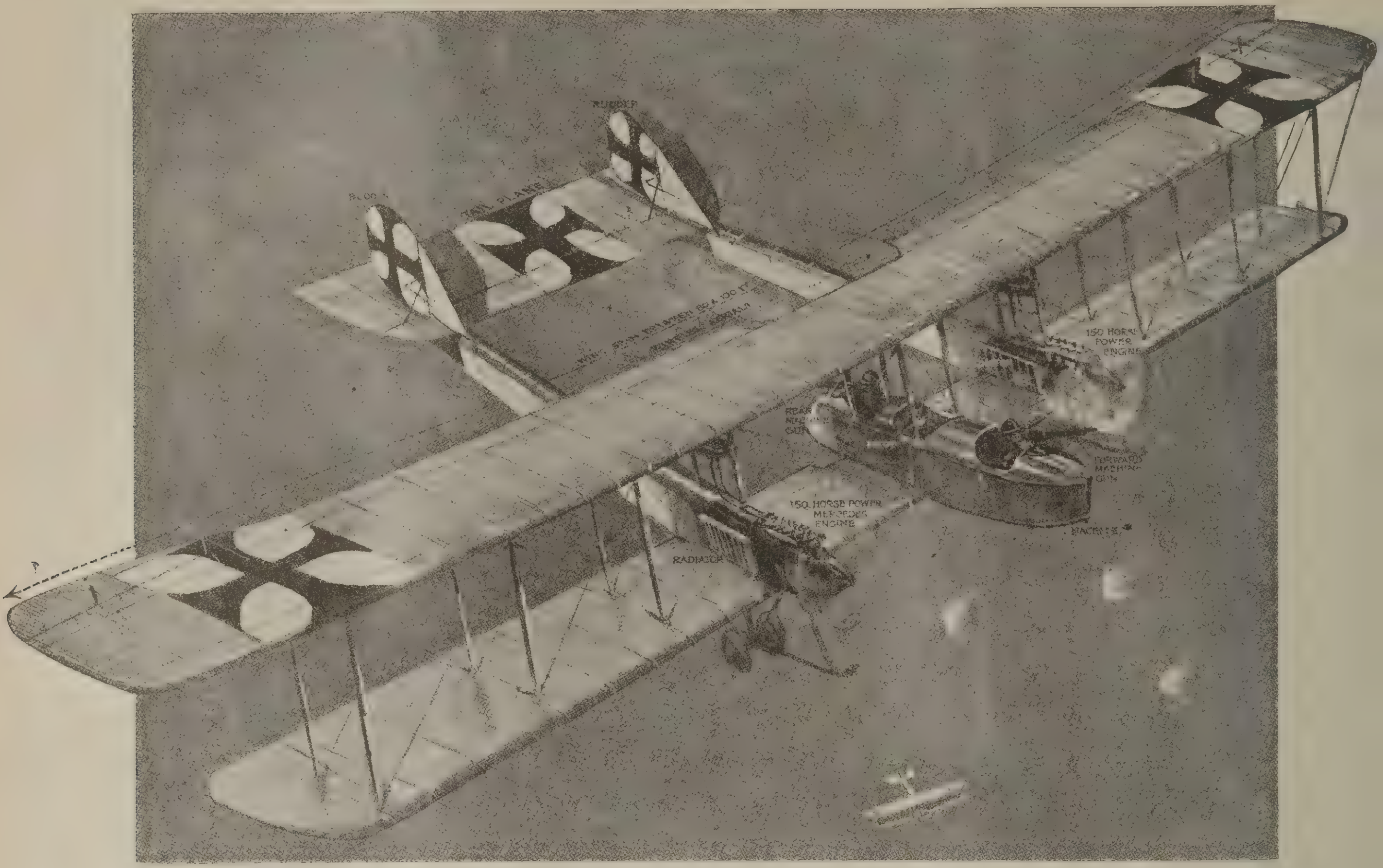
The Gallaudet seaplane combines the advantages of the pusher type with those of the tractor in that the pilot's and observer's views are unrestricted in all directions, the case with all pusher types, yet the seaplane possesses a fuselage, greatly lessening resistance. The machine is equipped with two Duesenberg engines of 150 h.p. each, driving two propellers. The part of the propellers nearest the center which absorbs power without producing any propulsive effort is inside the body so that the power usually lost in this portion is expended near the tips. The result is an increase in efficiency. The machine has a flying radius of 4 hours at 100 m.p.h. two engines running, or 11½ hours at 70 m.p.h. one engine running. The company is at work on a large order for the U. S. Navy.

Various Future Types

The companies in America who are engaged on the design and construction of twin-motored machines, the appearance of which may the anticipated this Spring and Summer, include the Aeromarine Plane and Motor Co., the Standard Aero Corporation, the Thomas-Morse Aircraft Co., The United Eastern Aeroplane Co., The Wright-Martin Aircraft Corporation, and The James V. Martin Aeroplane Co.



The large 60-foot Spread Voisin gun-carrier. This was the forerunner of the present smaller gun carriers and the newer and larger double-motored types. Note the six-wheel landing chassis, steel tube construction, small gap between planes and unique tail bearers. These tail bearers have since been discarded in favor of the regular steel tube outriggers



FOREIGN TWIN-MOTORED TYPES

Some of the more important twin-engine machines include the Sikorsky, the "Fritz," the Handley-Page, the Caproni, and the French "avion des chassé," the principal details of which are here given.

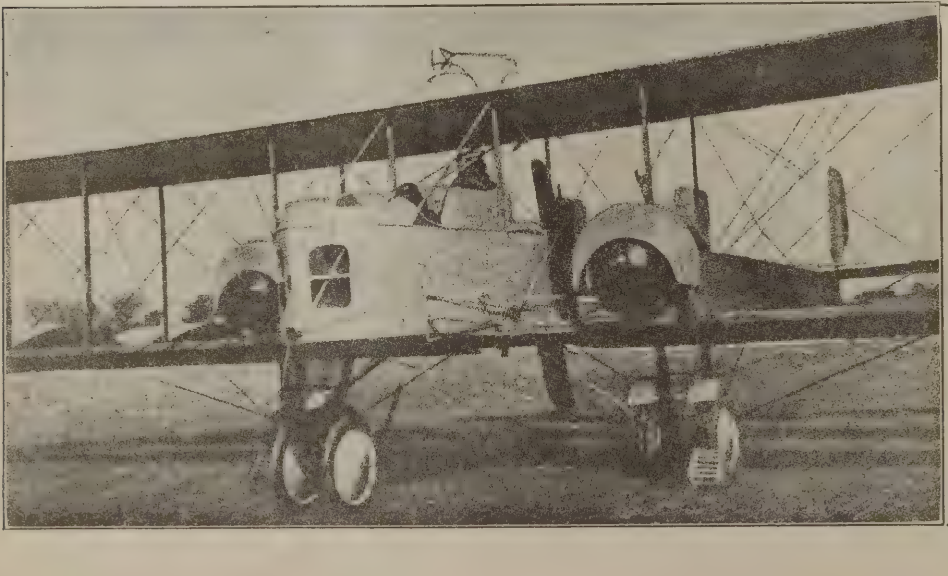
The Handley-Page

The twin-motored Handley-Page biplane carried twenty passengers in a test flight made recently at Hendon. Very little data is available concerning its dimensions, but it has been stated that it has a wing spread of about seventy feet, and a length over all of about 30 feet. The power plants are two Rolls-Royce motors. F. Handley-Page, designer, is one of the pioneer pilot-constructors in England, and he has many construction achievements to his credit. It would seem that his latest project would add to the sum total of his work.

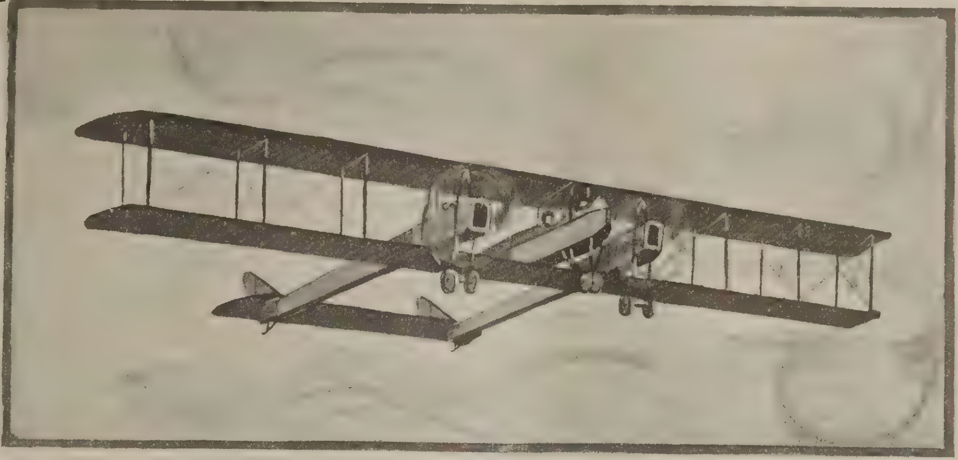
The "Fritz"

"Fritz" was the name given by the British aviators to the first German aeroplane to make its appearance over the trenches in Europe. It was somewhat graphically described in the *London Illustrated News* as follows:

"He is a big brute, anywhere between 80-foot and 100-foot span, and driven by two Mercedes engines of 100 h.p. to 150 h.p. each. These engines are placed in two narrow fuselages, whilst in the centre is a nacelle which contains seats for three men (two gunners and the pilot). The big machine remains aloft on patrol duty for six hours, his engines throttled down to their utmost limit, and thus enconomizing fuel. Should an enemy appear, the great watcher, some 8,000 feet to 9,000 feet above the Allies' trenches, suddenly accelerates to full speed. From the ground the giant engines can be heard, as they suddenly roar into full power, and the enormous ma-



A Caproni biplane of the latest type which has three Isotta-Fraschini, or Fiat, engines of 200 H.P. upwards. This machine is one of the most powerful "avions des chasse" in use in Europe



The Italian Caproni biplane, which is equipped with two Isotta-Fraschini motors

chine can be seen literally to swoop across the sky. With his two machine guns able to fire in any direction, he holds a great advantage over his enemies, and when he drives down upon them their only real chance is to dash for home at full speed. The Germans for a model have taken the Italian Caproni machine."

The Sikorsky

The first successful Sikorsky was completed in Russia but a few months before the outbreak of the great war, and was the result of years of experiments. One of the machines named the *Ilya Mouromets* was propelled by four Argus motors of 100 h.p.

It was asserted by the inventor that two of these motors could be put out of action without causing an accident. While the aeroplane was flying over St. Petersburg one day, one of the motors became frozen and stopped. The speed of the aeroplane was diminished, but it continued on its course, and presently one of the crew was able to thaw out the motor and start it again.

The *Ilya Mouromets* had a wing area of five times that of the ordinary Farman biplane. The metal fuselage, 65 feet long and the forward part of the fuselage contained a number of cabins extending over a length of 28 feet. The cabins had large windows on both sides and also windows in the floor for observation and photographic purposes. At night the cabins were lighted by electricity.

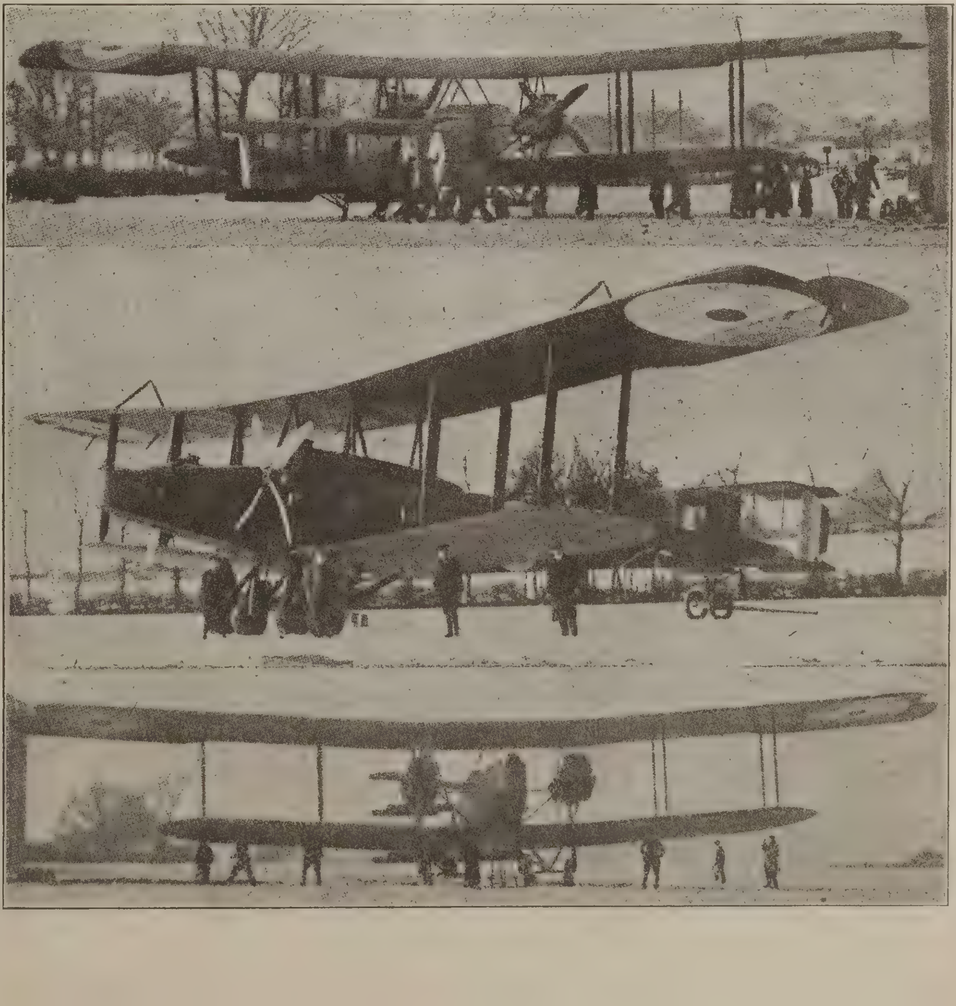
The total weight of the aeroplane was three and one-half tons. With a total development of 400 h.p. the *Ilya Mouromets* could raise a total useful weight of a little over one ton, besides nearly eight hundred-weight of fuel oil.

The mechanics moved about freely to attend to the motors and other parts of the machine without disturbing the equilibrium of the aeroplane while in flight.

During the past two years, giant biplanes of the Sikorsky type have been built in England, and equipped with Rolls-Royce motors, they have done excellent work.

The Caproni

The Italian Caproni, with two, three and four motors, has been built extensively, and used primarily as an "avion des bombardments." The spread varies from fifty to eighty feet and the motors used are Fiat, and Isotta-Fraschini.



Handley-Page, the designer of this machine, is one of the pioneer English pilot-constructors

SECOND ANNUAL REPORT OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

By WILLIAM F. DURAND, Chairman of the Committee

The National Advisory Committee for Aeronautics was established by Congress by act approved March 3, 1915. Under the law, the committee is charged with the supervision and direction of the scientific study of the problems of flight with a view to their practical solution, and the determination of the problems which should be experimentally attacked, their solution, and their application to practical questions of aeronautics. In the event of a laboratory or laboratories, either in whole or in part, being placed under the direction of the committee, the committee may direct and conduct research and experiments in aeronautics in such laboratory or laboratories.

The committee has twelve members, appointed by the President. As authorized by Congress, the personnel of the committee consists of two members from the War Department, from the office in charge of military aeronautics; two members from the Navy Department, from the office in charge of naval aeronautics; a representative each of the Smithsonian Institution, of the United States Weather Bureau, and of the United States Bureau of Standards; and not more than five additional persons acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical engineering or its allied sciences.

During the past year there was one change in the membership of the committee, caused by the retirement of Lieut. Col. Samuel Reber, United States Army, who was succeeded on the committee by Lieut. Col. George O. Squier, United States Army, as officer in charge of the Aviation Section of the Army.

The organization of the Advisory Committee, as of October 5, 1916, is as follows: Prof. William F. Durand, chairman; Naval Constructor H. C. Richardson, United States Navy, secretary; Prof. Joseph S. Ames, Capt. Mark L. Bristol, United States Navy; Prof. John F. Hayford, Prof. Charles F. Marvin, Hon. Byron R. Newton, Prof. Michael I. Pupin, Brig. Gen. George P. Scriven, United States Army; Lieut. Col. George O. Squier, United States Army; Dr. S. W. Stratton, Dr. Charles D. Walcott.

Relation of Work of the Advisory Committee to Army and Navy

In the course of the past year a number of problems of importance to the Army and Navy have come to the attention of the committee, and steps have been taken toward aiding these departments in arriving at solutions of the problems presented. Report No. 11 on gasoline carbureter design, which has just been prepared, and an investigation of air propellers, which is about to be inaugurated by the committee, will both be of value to the military branches of the Government. In the exercise of its function for securing co-operation the committee has enlisted the interest of the Bureau of Standards in the determination of the characteristics of the materials entering into aeroplane construction and in particular into the construction of air propellers, and the Bureau of Standards is already engaged on these problems. Through its subcommittee on motive power, the Advisory Committee has effected an active co-operation between the Government departments concerned and the Society of Automobile Engineers, which it is expected will at an early date enable the committee to place valuable information at the disposal of the Government departments and the aeronautic industry in general.

Aerial Postal Service

At the annual meeting on October 5, 1916, a representative of the Post Office Department was present, at the request of the committee, and informed the committee of the unsuccessful efforts of the Post Office Department to inaugurate an aerial postal service in Alaska and from New Bedford to the island of Nantucket.

It was apparent that, although aviation has made great strides in the past two years, the conditions of both of these routes were so severe as to deter responsible bidders from undertaking this service. After discussion of the entire matter, the committee concluded that the time has arrived when it is perfectly practicable to inaugurate such air service, and recommends to Congress that the Post Office Department be authorized to establish one or more experimental routes, with a view to determining the accuracy, frequency and rapidity of transportation which may reasonably be expected under normal and favorable conditions, and therefrom to determine the desirability of extending this service wherever the conditions are such as to warrant its employment.

The Advisory Committee will, if called upon, assist and advise the Post Office Department in the undertaking above recommended.

Work of the Committee

During the past year the Advisory Committee has held two meetings—on October 15, 1915, and April 20, 1916. The business transacted at these meetings appears under the various subjects treated in this report. At the meeting on October 15, 1915, the regulations were amended to provide that the secretary of the Advisory Committee, who had been ex-officio secretary of the secretary of the executive committee, be made a full voting member of the executive committee. This amendment was approved by the President on October 25, 1915. At the meeting on April 20, 1916, the committee adopted an amendment to the regulations changing the date of the annual meeting to the Thursday after the first Monday in October in order to enable it to give consideration to the preparation of estimates of expenses for the following fiscal year, which are required by law to be submitted by October 15 of each year. This change was approved by the President under date of April 27, 1916.

The Executive Committee

For carrying out the work of the Advisory Committee the regulations provide for the election annually of an executive committee to consist of seven members and the secretary, ex-officio. The organization of the executive committee, as of October 5, 1916, is as follows: Dr. Charles D. Walcott, chairman, Secretary Smithsonian Institution; Naval Constructor H. C. Richardson, United States Navy, secretary; Prof. Joseph S. Ames, physicist, Johns Hopkins University; Capt. M. L. Bristol, United States Navy; Prof. Charles F. Marvin, Director United States Weather Bureau; Prof. Michael I. Pupin, physicist and electrical engineer, Columbia University; Lieut. Col. George O. Squier, United States Army; Dr. S. W. Stratton, Director Bureau of Standards.

The program of work approved by the Advisory Committee was entrusted to the executive committee for execution. The executive committee was directed to consider a program of investigation and procedure intended to carry into effect the purposes of the act creating the Advisory Committee and to report the same with recommendations. The executive committee accordingly held regular monthly meetings throughout the year, and in addition held three special meetings. The reports of work done by the executive committee and its recommendations have been approved by the general committee and are incorporated into this report.

To facilitate the work of the committee the following subcommittees were formed and progress has been made on the general lines indicated in the designations of these committees:

Relation of the atmosphere to aeronautics.
Standardization and investigation of materials.
Aeronautical nomenclature.
Radiator design.
Motive power.
Specifications for aeronautic instruments.
Design, construction and navigation of aircraft.
Site for experimental field.
Governmental relations.
Bibliography of aeronautics.

Technical Reports

During the past year, owing to the very limited funds available for the use of the committee, only one contract for a special report was placed. This was for an investigation and report on the subject of gasoline carburetor design. Technical Reports Nos. 8 to 12, inclusive, are submitted herewith as appendixes.

Report No. 8 prepared by the subcommittee on specifications for aeronautic instruments covers the subject of general specifications for aeronautic instruments. The object of this report is to acquaint manufacturers with the types of instruments required for aeronautic purposes and the conditions to be met in the uses of these instruments in connection with the navigation and operation of aircraft.

Report No. 9, covering the subject of aeronautical nomenclature, was prepared by the subcommittee on aeronautical nomenclature. The subcommittee charged with its preparation very thoroughly investigated the new terms which have come into use with the development of aviation and after consideration of such limited contributions as were available on this subject, and the comments of aviators of the Army and Navy, and of manufacturers, adopted this nomenclature for the purpose of eliminating the confusion that has already come into existence in the use of aeronautical terms. In the preparation of this nomenclature, it appeared unnecessary to define any terms already well established in other branches. Particularly, it appeared unnecessary to define such terms as are familiar to all users of automatic engines; so that the nomenclature adopted by the committee principally comprises terms that are peculiar to, or new in, aeronautics.

Report No. 10 is a preliminary report of progress in the design and construction of a suitable form of muffler for aeronautic engines. This is a rather difficult problem and requires a large amount of experimental work. In this preliminary report it is pointed out that there are other than exhaust noises to be contended with even more difficult of elimination. This special report was prepared and submitted by Profs. H. Diederichs and G. B. Upton, of Cornell University, Ithaca, N. Y., under contract made in June, 1915. As definite results have not as yet been attained, experimental work and investigation will be further pursued during the present fiscal year.

Report No. 11, previously referred to, is a very complete and valuable report on gasoline carburetor design and throws light on a rather neglected subject. This special report was prepared and submitted by Prof. Charles E. Lucke, of Columbia University, New York, N. Y.

Report No. 12, entitled "Experimental researches on the resistance of air," by L. Marchis, professor in the Faculty of Sciences of Paris, is an admirable résumé of the status of experimental research at the present time. It is not an original paper, having been translated from the French by Prof. William F. Durand, a member of the committee.

A report on the "Physics of the air" has been prepared by the subcommittee on the relation of the atmosphere to aeronautics and printed in pamphlet form by the Smithsonian Institution. This report should be valuable to aviation officers, who obviously desire to know the causes of atmospheric phenomena, as well as to practical aviators, as many of the results, especially those given in tables and diagrams, are in form for quick and easy use by the practical pilot. The report as published is an abstract from the complete report of that material which is of special interest to navigators of the air.

General Problems

The problems enumerated in the first annual report of the committee constituted the program of work during the past year. These problems are considered of immediate importance, and will be attacked on a larger scale by the committee as soon as funds are made available for the purpose.

A. STABILITY AS DETERMINED BY MATHEMATICAL INVESTIGATIONS.—The work inaugurated by Asst. Naval Constructor J. C. Hunsaker, United States Navy, on these lines has been extended, and is now being carried on by Prof. A. Klemin, who has succeeded Naval Constructor Hunsaker at the Massachusetts Institute of Technology. Prof. Klemin is endeavoring to reduce this problem to a practical form, which will permit of the determination of the proper proportions of the different elements of the aeroplane design in order to insure the desired qualities, and it is expected the committee will be able to obtain a report on this work during the coming year.

B. AIR SPEED METERS.—A number of engineers are engaged in solving this problem, and a preliminary design has been worked out at the Washington Navy Yard, and has shown fair results in actual service. Upon the completion of experiments the data relative to same will be available to the committee.

C. WING SECTIONS.—No direct investigation bearing on the improvement of the form of the wing itself has been made but work of considerable interest has been carried out at the Massachusetts Institute of Technology under the direction of Naval Constructor Hunsaker, and reports have been published in a number of aeronautical papers and in Smithsonian Miscellaneous Collection, volume 62, No. 5, June 30, 1916. These reports include discussions of the advantages to be gained by changing the relations and proportions of the upper and lower wings in a biplane arrangement and also the effects produced in the triplane arrangement. Investigations show that by giving the upper wing a strong stagger and a larger angle of attack than the lower wing it is possible to obtain practically any desired degree of stiffness longitudinally, and this can be done even without the use of stabilizing tail planes. This contribution places this feature of design in a very satisfactory condition, analogous to that of the design of ships, in which the metacentric height is made to suit the conditions of service. It appears that for general service, and particularly for military service, an aeroplane having a very moderate longitudinal stiffness and ample controls for modifying the attitude of the machine, combined with proper damping surfaces affords the most satisfactory solution.

D. Engines.—In addition to the investigation of mufflers reported last year, the committee has inaugurated an investigation of the subject of gasoline carburetors, but otherwise, due to the limited funds, no direct investigations have been carried on by the committee. However, the results of the meeting of June 8, 1916, when the committee held an open conference with representatives of several manufacturers of aeronautic engines, have rapidly accumulated, and through cooperation with the Society of Automobile Engineers, through the subcommittee on motive power, the committee is closely in touch with engine development and is cooperating in every manner possible, principally by bringing the War and Navy Departments in close touch with this society, and thereby the manufacturers, so that many of the problems of engine design are already well in hand.

E. Propellers.—Very recently the propeller problem has assumed considerable importance, due to the difficulties experienced with wooden propellers handling large power at high speeds of revolution. This problem has been particularly serious in the air service of the War Department on the Mexican border because of the severe climatic conditions, which have seriously affected the life of the propellers. These problems are principally problems of mechanical construction and not problems of design involving the form of the propellers or their efficiency, and on the latter subject no progress has been made, as far as is known to the committee, and no satisfactory engineering data is available for design purposes.

The committee has just entered into a contract with Prof. William F. Durand, which will be carried out at Leland Stanford Junior University for an investigation of models of propellers with a view to establishing engineering data for design.

F. Form of aeroplane.—This has already been referred to under "A".

G. Radio telegraphy.—No particular progress is reported on this line, although both the War and Navy Departments have carried on investigations on these lines, and considerable success has been attained in recent experiments in the Army.

The Navy has also experimented at Guantanamo and carried on work at Pensacola. The Bureau of Steam Engineering of the Navy Department has also provided a number of aeroplane radio sets, and the Bureau of Standards has developed a radio direction indicator which will be given practical trials in the naval service at an early date.

Physical Problems

Besides the more general problems, the following problems of a physical rather than aeronautical nature are of particular interest. These problems were noted in the first annual report, but, owing to the lack of funds, very little progress has been made toward their solution during the past year.

A. Noncorrosive materials.—Investigation of noncorrosive materials at the Bureau of Standards has been continued, but no report is yet available.

B. Flat and cambered surfaces.—No progress is reported.

C. Terminal connections.—No additional progress is reported.

D. Characteristics of constructive materials.—This work has been begun by the Bureau of Standards, but no report is yet available.

E. Generation of hydrogen.—The Bureau of Steam Engineering of the Navy Department has taken up this work in connection with the installation of hydrogen plants aboard ships, but no report is available.

F. Standardization of nomenclature.—This subject is covered by Report No. 9, which accompanies this report.

G. Standardization of specifications for materials.—This subject is an extremely broad one and is being handled by the committee in cooperation with the Society of Automobile Engineers. One prominent manufacturer of aircraft has already developed a very good set of specifications for his own use, but these specifications are more or less particular in form, because of the present unusual condition of the material market.

H. Bibliography of aeronautics.—Negotiations are under way for the issuance of a report bringing this subject up to date.

I. Collection, revision and issuance of reports covering the state of the art of aeronautics have not been undertaken as it now appears probable that it will be unnecessary because of the number of good publications which already exist.

J. Limitation of size.—No steps have been taken by the committee toward the solution of this problem. An interesting article on this subject by F. W. Lanchester, member of the British Advisory Committee for Aeronautics, is noted in the Scientific American of June 3, 1916.

K. Causes of accidents.—Although this problem is a serious one, the committee has not been able to inaugurate the work proposed.

Co-Operation With Aeronautic Industry

At the meeting of the executive committee on May 11, 1916, an important step was taken when it was decided to invite representatives of different aeronautic engine manufacturers to be present at a meeting of the executive committee, to discuss the engine problem with the committee with a view to bringing out clearly the difficulties encountered by manufacturers in meeting the exacting demands of aviators and with a view to a more complete understanding between the builders and users of aeronautic engines. Accordingly, the executive committee held a public session on June 8, 1916, at which were present representatives of various manufacturers of aeronautic engines and in addition to the members of the committee representing various Government branches, there were also present, on invitation of the committee, special representatives of the War and Navy Departments familiar with the practical problems involved in the use and development of aeronautic engines. The Naval Consulting Board of the United States was also represented.

The proceedings of this meeting, being of great interest to the aeronautic industry in general, have been given wide circulation by the committee. One of the results of the meeting has been the inauguration of an important movements for the development of satisfactory aeronautic engines. This will undoubtedly serve to stimulate cooperation between the Government departments—the principal users of aircraft at present—and the principal producers of aeronautic engines. Thus, the Advisory Committee has already inaugurated one of the most important services for which it was established. Through the agency of the thoroughly established organization of the Society of Automobile Engineers, many of the steps which impeded progress in the development of the automobile should be avoided in the further development of the aeronautic engine, and powerful and competent agencies brought to bear to aid in the solution of difficult problems.

From such information as the committee is able to obtain, it now appears that the aeronautic engine problem, which was in an unsatisfactory condition a year ago, has greatly improved.

Standards of Work

The Government agencies fully appreciate the necessity of the adoption of standards of work and are taking steps toward the securing of such standards. It is of the greatest importance that the manufacturers of aircraft should work in harmony with the Government, at present the principal consumer, and that they should come to definite agreements as to the standards of work necessary to facilitate production and repairs. The committee, through the subcommittee on motive power, is assisting in this work of cooperation.

Existing Facilities for Aeronautic Investigations in Government Departments

Limited facilities for aeronautic investigaions in Government departments were reported in the first annual report, and it is anticipated that extensive additions to the existing facilities will be developed during the year 1917.

Quarters for the Committee

In the appropriation for the expenses of the committee for the fiscal year 1917, provision was made for the rental of quarters. The committee reports that quarters in the Munsey Building, adequately meeting the needs of the committee at present, have been secured. However, the increase in work contemplated by the committee, and authorized in the last appropriation, will require additional office space, and the committee recommends that the amount for office rent be increased as indicated in the estimates of expenses for the next fiscal year.

Financial Report

Out of the appropriation of $5,000 for the expenses of the committee for the fiscal year 1916, the committee reports expenditures and obligations during the year amounting to $4,904.28, itemized as follows:

Expenditures and Obligations Incurred Under Appropriation "Advisory Committee for Aeronautics, 1916"

Traveling expenses	$862.70
Furniture and equipment	363.57
Printing	419.60
Stationery	52.42
Telegrams	5.99
Clerical services	1,200.00
Special report (Carburetor investigation by Prof. Charles E. Lucke, of Columbia University, New York, N. Y)	2,000.00
Total	$4,904.28
Balance turned into treasury	95.72
Amount of appropriation	$5,000.00

Estimates and Recommendations

The following estimates of expenses for the fiscal year 1917-18 have been submitted by the committee in due form:

For scientific research, technical investigations, and special reports in the field of aeronautics, including the necessary laboratory and technical assistants: traveling expenses of members and employees; rent (office in the District of Columbia not to exceed $1,500); office supplies, printing and other miscellaneous expenses; clerks; draftsmen; personal services in the field and in the District of Columbia: *Provided,* That the sum to be paid out of this appropriation for clerical, drafting, watchmen and messenger service for the fiscal year ending June thirtieth, nineteen hundred and eighteen, shall not exceed $12,000; in all, $107,000.

It is strongly recommended by the committee that the next appropriation for the direction and conduct of research and experiment in aeronautics, and the committee's work in general, be made in lump sum with limitations only on clerical and drafting services and office rent in the District of Columbia.

For the fiscal year 1916-17 there was appropriated $85,000, as follows, which became available August 29, 1916:

Traveling expenses of members and employees		$2,000
Two technical assistants, at $2,500 each	$5,000	
One clerk	1,500	
One clerk	1,000	
One draftsman	2,000	
One draftsman	1,000	
Two laborers, at $660 each	1,32[illegible]	
Three mechanics, at $1,200	3,600	
		15,420
Rental of office		1,200
Supplies		7,800
Special reports		5,000
Movable combination field office, machine shop, dynamometer shed, hangar and power plant		15,000
Dynamometer carriage and truck		18,000
Aeroplane, including motor		10,000
Transmission dynamometer		1,000
Ripograph		1,000
Stabilizer		1,500
Anemometers, barographs, inclimometers, incidence indicators		1,500
Miscellaneous supplies, spare parts for operation of field plant		5,580
Total		$85,000

Owing to the many changes that have occurred in the rapid advance in the development of the art of aeronautics, it will be necessary to obtain further authority before a considerable portion of this appropriation can be used to the best advantage. The committee therefore also recommends that authority be granted to expend any remaining balances of the appropriation for the fiscal year 1916-17 under the same terms recommended for next year's appropriation. This would leave the committee free to use its funds in the most effective manner and transmit to Congress an itemized account of expenditures in its annual report.

Conclusions

The carrying on of the work authorized in the last appropriation depends largely on the availability of a suitable field for the location of the field laboratory and its equipment. In the last appropriation for the War Department Congress authorized the securing of fields for Army purposes, and the War Department has called on this committee for its advice respecting the conditions governing the selection of a suitable site for a proving ground for aircraft.

It seems to the committee that considerable advantage would be gained if the site selected for the War Department would also be such as to be suited to the requirements of this committee, as well as to the Navy Department, and, with this purpose in view, the committee has solicited the advice of both the Navy and War Departments in this matter. As a result the committee has been able to advise each as to the requirements of the other and of this committee in the location of such a proving ground, and the site finally selected by the War Department met with the approval of that department and of this committee. Neither this committee nor the Navy Department has authority or funds available for purchasing a site, the War Department only having authority and funds.

It is contemplated that a part of any site selected by the War Department may be made available for certain uses of the Navy Depart-

(*Continued on page* 154)

HOW YOU CAN JOIN THE AVIATION SECTION, SIGNAL OFFICERS' RESERVE CORPS

To answer the inquiries of the hundreds of applicants who wish to join the Aerial Reserve Corps the military authorities have issued a circular which answers the queries, as follows:

1. Q.—What is the Officers' Reserve Corps?
   A.—The Officers' Reserve Corps is a body of civilians who have received five-year commissions from the President of United States as Officers in the reserve of the regular army.
2. Q.—What is the Aviation Section, Signal Officers' Reserve Corps?
   A.—The Aviation Section, Signal Officers' Reserve Corps, is that portion of the body above mentioned which acts as a reserve for the Aviation Section of the regular army, in the same manner that the Medical, Engineer, Artillery, and other sections of the reserve, act as reserves for the corresponding organization in the regular service.
3. Q.—What obligations do I incur by entering this reserve corps?
   A.—In entering this reserve corps you are obligated to serve fifteen days per year in time of peace. In time of war or threatened war, you are subject to the call of the President. You cannot, however, be called out in a lower grade than that in which you are commissioned.
4. Q.—What are the qualifications required?
   A.—The qualifications required are three: mental, moral and physical.
5. Q.—What are the mental requirements?
   A.—The mental requirements are these: The applicant must show that he possesses a college education or its equivalent in experience of a military, technical, executive or other nature, which would enable the Board to waive the strict requirements necessitating a college education.
6. Q.—What are the moral requirements?
   A.—The moral requirements are established by letters of recommendation from three reputable persons. In the case of previous military service on the part of the applicant, he must submit statements of satisfactory service.
7. Q.—What character of physical examination must I pass?
   A.—The physical examination is the same as that required of applicants for aviation service in the regular army. It is a thorough examination lasting about two and one-half hours, which should be passed by the average man, free from organic disability and in good health. Special stress is laid upon good hearing and eyesight.
8. Q.—What are the flying qualifications?
   A.—The applicant must pass, before being commissioned, the Reserve Military Aviator's flying test. Unless he can pass this flying test he will not be given a commission. He will be assisted by the United States in obtaining the training necessary to fit him for a commission, provided he meets the other requirements prescribed above.
9. Q.—How long will course of training be?
   A.—The course of training will ordinarily take at least three months.
10. Q.—What kind of training will I undergo?
    A.—You will be required to undergo both a military and an aviation training to fit yourself for the position of an Officer Aviator.
11. Q.—Where will this training take place?
    A.—This training will take place at schools maintained under the supervision of the War Department. One of them is now established at Mineola, Long Island, N. Y., another at Memphis, Tenn., and others will be opened as opportunity permits. Civilian schools may also be designated by the War Department. At present there are two of these, the Curtiss Aviation School at Newport News, Va., and at Miami, Florida.
12. Q.—What expense will I incur?
    A.—All expenses will be paid by the United States if enlisted in the Aviation Section, Signal Enlisted Reserve Corps.
13. Q.—Do I have to enlist in the Enlisted Reserve Corps in order to receive Aviation training?
    A.—No. You can receive instruction and pay your own living and travel expenses. While receiving training at your own expense, however, you will be required to attend regularly both the military and aviation instruction courses.
14. Q.—What is the pay of the non-commissioned officer grades to which I might be assigned by enlistment?
    A.—You will be enlisted as Sergeant in the Enlisted Reserve Corps, the actual pay of which will be $36.00 per month, which with allowances for food, clothing, etc., will be brought to the equivalent of approximately $75.00 per month.
15. Q.—What rank will I have on completing the prescribed course?
    A.—On completing the prescribed course you will be given a rank as a 1st Lieutenant in the Aviation Section, Signal Officers' Reserve Corps, and placed on the inactive list. However, if in the opinion of the Secretary of War, you have special qualifications, he may, with your consent, retain you on active duty as long as there are funds available for that purpose and for such a period as he (Secretary of War) may elect.
16. Q.—What are the pay and allowances of this rank on active service?
    A.—The pay and allowances of this rank are as follows: Base pay $166.66; Commutation of Quarters (where no public quarters are available) $36.00 per month. In addition, while on flying duty you will be granted a 25% increase of pay.
17. Q.—If I am enlisted in the Enlisted Reserve Corps and my services prove unsatisfactory am I required to serve out my enlistment?
    A.—No. If your services prove unsatisfactory or in the opinion of the Officer in Charge of Training you have not the qualifications of a flyer, you will be discharged, or if training at your own expense, you will be dismissed.
18. Q.—When would I have to start training?
    A.—You would be required to start training as soon as you are assigned to a training school and continuing for three or more months.
19. Q.—How could I withdraw during the course?
    A.—If you desire to withdraw during the course, you must submit an application for discharge stating your reasons.
20. Q.—Where do I apply for information?
    A.—Apply for information to the following:
    1. The Chief Signal Officer of the Army, Washington, D. C.
    2. The President, Aviation Examination Board, Mineola, L. I., N. Y.
    3. The Aviation Officer, Central Department, Chicago, Ill.
    4. The Aviation Officer, Southern Department, San Antonio, Tex.
    5. The Commanding Officer, Signal Corps Aviation School, San Diego, Cal.
21. Q.—What steps must I follow to secure admission to this course of training?
    A.—To secure admission to this course of training you must:
    1. Write to any of the above for application blanks.
    2. Fill out required blank and return it.
    3. Present yourself for physical examination at time prescribed by the Examining Board.
    4. Appear before the Board at time prescribed by them for mental and moral examination.
    5. If accepted by the Board, you will be recommended for enlistment with a view to securing the necessary aviation training to qualify yourself for a commission. If so recommended, you will be ordered to report for enlistment at an enlistment depot. Upon being enlisted, you will be required to submit an application requesting that you be assigned to active duty at any Aviation School.
    6. Application will be approved, and you will be assigned to duty at a designated school for aviation training.
22. Q.—After passing the prescribed flying tests, do I have to accept a commission in the Aviation Section, Signal Officers' Reserve Corps?
    A.—When you are accepted for training and before you can start same, it will be necessary for you to make a signed statement on honor to the effect, that after pasing the prescribed flying tests satisfactorily you will accept a commission in the Aviation Section, Signal Officers' Reserve Corps.

D'ORCY'S AIRSHIP MANUAL

INTRODUCTION

D'Orcy's Airship Manual—the first installment of which is herewith published—is the result of a methodic investigation which was undertaken by the writer for the purpose of presenting an exhaustive but tersely worded register of the world's airship production, such as has not hitherto been available.

In principle *D'Orcy's Airship Manual* furnishes, whenever available, complete data for every airship of 500 cubic meters and over, which has been laid down from 1834 to August 1st, 1914. Smaller airships are listed only if they embody unusual features. In order to present a comprehensive view of each country's share in this novel industry, every airship is listed in chronological order under the name of her builder and all airship builders are listed in alphabetical order, according to countries. As to the airships laid down since the outbreak of the Great War it has been attempted to furnish the most complete and up-to-date information regarding the vessels built by the Central Powers and the neutral countries; data regarding recent airship constructions of the Allies had to be withheld for military reasons, unless previously published.

A complete list of the world's airship harbors is appended to the airship register.

The hitherto customary division of airships into the rigid, semi-rigid and non-rigid types—which was based on primitive and now obsolescent conceptions—has been found totally inadequate to express the features of novel sub-types which have more recently been produced; it has therefore been deemed advisable to adopt a new nomenclature, based on the constructional features of the hull which alone permit fundamental differentiation.

Whereas every airship hull presents to the relative wind an essentially rigid body, it follows that the term "rigid" cannot logically be applied to one particular airship type, the same argument barring also the terms "semi-rigid" and "non-rigid". Consequently all airships in which the shape of the hull is rendered permanent by means of a rigid structure, the hull frame, are here termed *structure airships,* whereas all those in which the shape of the hull is maintained through an excess of inner pressure, relative to the atmospheric pressure, are here listed as *pressure airships.* The latter are further subdivided, according to their suspension system, as follows:

(1) The *girderless type,* in which the load, carried on a short car, is directly distributed over the hull by means of branched suspension ropes attaching to hems which are sewn onto the hull. (Example, *Parseval.*)

(2) The *car-girder type,* in which the load is distributed over the hull by means of a long girder hung thereto, part of which is fitted as a car. (Example, *Astra.*) A divergent application of this principle consists in fitting a short car with fore-and-aft out-riggers (ex. *Koerting*).

(3) The *Keel-girder type,* in which the load, carried on a short car, is distributed over the hull by means of a girder attached to the underside of the hull. This girder may be built into the hull (ex. *Lebaudy*) or be hung thereupon (ex. *Gross-Basenach*); it may be articulated (Italian Army airships) or entirely rigid, with a car contained in its under part, thus doing away with suspension ropes (ex. *Forlanini*).

(4) The *Tension-truss* or *Astra-Torrès type,* in which the load is distributed over a hull of trefoil section by means of a truss contained within the hull and a branched suspension attaching thereto.

The "tension truss" consists of four cables running from bow to stern, three of which are sewn onto the hull at the intersection lines of the three lobes and are trussed to a fourth cable which follows the imaginary axis of the hull. When the hull is under pressure, the truss is under tension and acts as a girder which transmits the load *evenly* over the entire hull. Thanks to this feature, airships of the tension-truss type can be kept rigid, while under way, with an excess of pressure of only 3 to 4 mm water, whereas all other pressure airships require an average pressure of 25 mm water.

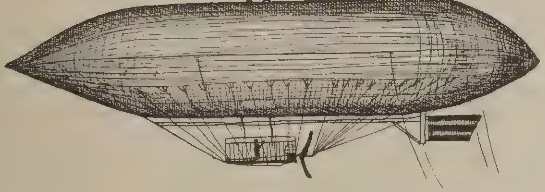
(*Continued on page* 153)

AUSTRIA

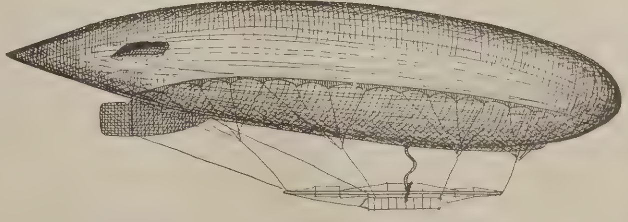
Boemches (Captain F.), Vienna—Builder of a pressure airship of the car-girder type. Girder consisting of a short car fitted with bow-outrigger only. Height control through lifting planes and compensating ballonets.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**Boemches** (1912)	57	9	2,750	72	40	Experimental airship—Two Koerting engines; twin-screws. The airship did not prove satisfactory on her trials and was dismantled the following year. (Photo wanted.)

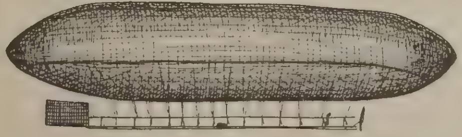
AUSTRIA



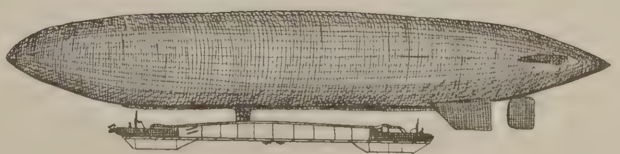
Haenlein - (1872)



Koerting - "M.III. (1911)



Renner - "Estaric" (1909)



Stagl & Mannsbarth - "Austria" (1911)

AUSTRIA—(Continued)

Haenlein (Paul), Vienna—Builder of a pressure airship of the keel-girder type. Height control through ballast shifting.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**Haenlein** (December, 1872)	**50.4**	**9.2**	**2,400**	**3**	**4.5**	Experimental airship—One Lenoir gas engine fed by the foal-gas contained in the hull; one pusher-screw. The trials disclosed the inadequacy of the power-plant, which barely enabled the airship to make any headway.

Koerting (Maschinenbau A. G.), Vienna—Builders of a pressure airship of the car-girder type. Girder consisting of a short car with two outriggers. Height control through two compensating ballonets and trimming tanks, the latter being operated by compressed air.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**M. III.** (January, 1911)	**68**	**10.5**	**3,600**	**150**	**49**	Austrian Army airship—Two Koerting engines; twin-screws. Ballonets: 900 mc. A fairly successful vessel. Was accidentally destroyed on June 20th, 1914, over Schwechat (near Vienna) through being rammed by a military aeroplane. The crews of both aircraft perished.

Motor-Luftfahrzeug Gesellschaft, Vienna—Builders of pressure airships to various designs.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**M. I.** (November, 1909)	**50**	**8.6**	**2,450**	**100**	**44**	Austrian Army airship—Built to the designs of the Luft-Fahrzeug-Gesellschaft (Parseval's patents). Girderless pressure type. Height control through two compensating ballonets and self-shifting car. Ballonets: 400 mc. One Austro-Daimler engine; one pusher-screw. Best endurance: 200 km. in 7 hrs. Dismantled in 1913.
2	**M. II.** (May, 1910)	**70**	**10.9**	**4,800**	**130**	**45**	Austrian Army airship—Built to the designs of Messrs. Lebaudy Frères. Keel-girder pressure type. Height control through lifting planes. Ballonet: 1,300 mc. One Austro-Daimler engine; twin-screws. Designed endurance: 10 hrs. Best altitude: 1,350 m. Dismantled in 1913.

Renner (A. & J.), Gratz—Builders of a pressure airship of the car-girder type.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**Estaric** (July, 1909)	**32**	**6**	**700**	**40**	**35**	Exhibition airship—One Puch engine; one tractor-screw. Was wrecked by the storm on Nov. 28th, 1910, while landing.

Stagl & Mannsbarth, Vienna—Builders of a pressure airship of the car-girder type. Height control through lifting planes, swivelling screws and compensating ballonets. Four compartments.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**Austria** (1911)	**91**	**13.2**	**8,150**	**260**	**65**	Experimental airship—Four ballonets: 2,500 mc. Two Austro-Daimler engines; two pairs of twin-screws and two swivelling screws, one fore and one abaft. Best endurance: 8¼ hrs. Dismantled in 1914 and sold at auction.

This excess of pressure is generated on all pressure airships by means of one or more *ballonets* or bladders which are located in the bottom of the hull and can be inflated with air through a fan-blower. A contraction of the gas and the resulting loss of volume and deformation of the hull are thus compensated by an expansion of the ballonet; on the contrary, an expansion of the gas beyond a certain limit (generally 30 mm water) will open the ballonet valves and receive the pressure without loss of gas, through the only escape of air. Should, however, the pressure still rise in spite of the open ballonet valves the pressure within the hull will be relieved by the automatic gas valves which are generally timed to open at 35-40 mm. water.

On certain pressure airships two ballonets are fitted which can respectively be pumped full of air whereby the vessel's trim may be changed without the use of lighting planes (elevators). The latter are chiefly employed on structure airships; on pressure airships their use is much less general, owing to the difficulty of aligning the elevators with the centre of resistance. Changes of trim can also be effected by means of communicating water tanks and, lastly, through lifting screws which may be of the stationary or swivelling type. The latter may also be employed for steering in the horizontal plane, although the use of a rudder is practically generalized.

Fore-and-aft oscillations, in other words *pitching* and *yawing*, are counterbalanced on practically all modern airships by means of surface fins, fitted on the stern, which have long since displaced the inflated fins of cylindrical or pear-shaped design.

On modern airships the shape of the hull is a matter of the greatest concern, lest undue impact and frictional resistances be encountered while under way. The best presently known hull shape, as determined by aerodynamic research work, is one six diameters long, with the master diameter located at about 40 per cent. overall length aft of the bow and with the bow blunter than the stern, both ends tapering and well rounded off.

Less attention has thus far been paid to the construction of the car, which on pressure airships is usually of rectangular section, although it would seem obvious to make it of streamline shape, as outlined above.

Quick computation of airship performances can be arrived at through the following basic laws.

(1) One cubic meter (1 mc) of pure (electrolytical) hyrogen at 15° centrigrade and 760 mm barometric pressure lifts 1.13 kilograms (kg);

(2) The lift *decreases* by 4 per mil of its value whenever the temperature *increases* by 1° centigrade and vice-versa;

(3) The lift *decreases* by 1 per cent of its value whenever the barometric pressure *decreases* by 1 per cent of its value and vice-versa;

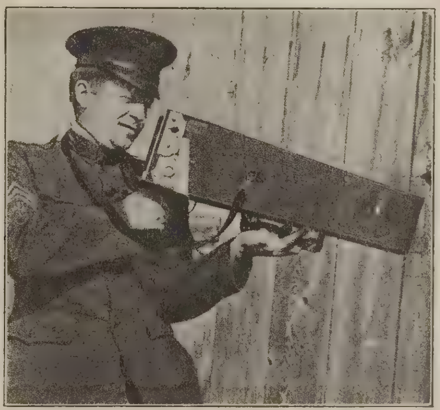
(4) The barometric pressure *decreases* by 1 per cent of its value whenever the altitude above sea-level *increases* by 80 meters.

In compliance with the advice given by the National Advisory Committee for aeronautics, all data in *D'Arcy's Airship Manual* are expressed in the metric system. For the convenience of readers unfamiliar with the metric system the approximate equivalents of the units employed are herewith given in English measures:

1 meter (m) = 3 1/3 feet.
1 kilometer (km) = 6/10 statute mile.
1 cubic meter (mc) = 35 1/3 cubic feet.
1 kilogram (kg) = 2 1/5 pounds.

(To be continued)

THE EASTMAN AEROPLANE CAMERA



THE product of four years of experimenting and testing, a camera which is said to be admirably suited for aeroplane work, has been perfected by the Eastman Kodak Company, according to an announcement by George Eastman.

Following tests at the naval aviation station at Pensacola, Fla., and on the Pacific coast, in which pictures of impressive clearness and detail were taken at altitudes ranging from 3,500 and 5,000 feet with the aeroplanes going eighty-five miles an hour, the Government has asked the immediate delivery of twenty cameras and a bid on a contract for sixty additional.

The new camera is a box two feet long, carries a pistol grip, gun sight and trigger, and when in use will be pitched, most of the time, at an angle of forty-five degrees. This slant will give the camera a wider sweep and make it of infinitely more value than the machines now in use on English planes which are adjusted to the bottom of the plane, with the shutter controlled by means of a cord.

It is understood that an aerial photographer with the British flying corps who wishes to take a shot, pictorially speaking, must be plumb above his object. In case he misses or overrides, he is compelled to circle and come back over the certain bit of topography, trench or ambush that he wishes to snap.

The Eastman camera carries, among other devices, a safety shutter on the end that is pointed toward the earth, as a protection against fog and the possibility of spray or mist blurring the glass. The camera weighs about fifteen pounds.

Midway between the front and the back of the case are buckles for the straps to go over the shoulders of the operator, thus allowing him the free use of his hands in an emergency. The machine will rest against the body of the aviator, which will form a cushion much on the order of a floating axle in an automobile.

William F. Folmer, manager of the Folmer & Schwing division of the Eastman Company, is given major credit by Mr. Eastman for the development of the aeroplane camera. When the Wrights began to fly several years ago, Mr. Folmer appreciated that a new field of navigation was opening and that the air, like the land, would find need for the camera.

The start was made by sending up a camera on kites suspended from captive balloons. A winged turbine advanced the film and reset the shutter, but the results caused despair. After months of experimenting one picture—a bird'seye of Kodak Park that was enlarged and now hangs in Mr. Eastman's office—was obtained.

The next step was taken with a graflex, which gave fair satisfaction. The chief fault of this method rested with the bellows. A wind striking the bellows created a tremor, it was found, and blurred the pictures.

When the Eastman Kodak Company began its third attempt to find a suitable instrument for air work, it prefaced the actual building of a camera by a world-wide survey of what other countries had done. Nothing was found to encourage them to pattern after any camera in use abroad. Whatever it was to have, it was finally decided, was to be had only through domestic genius. The aeroplane camera which has proved acceptable to the Government is the outgrowth of Folmer persistence.

The graflex focal plane shutter with which the new instrument is equipped is capable of speed from time to 1-1000th of a second. It is said that if an aeroplane accomplished the highly impossible speed of 300 miles an hour in the air, it would still be possible to arrest the object with the aeroplane camera.

Roads, cow paths and shrubbery taken from a height of 5,400 feet at Pensacola are remarkably distinct in the prints, four by five inches. They were caught with the shutter working at a speed of 1-295th of a second.

The camera will be built to use both plate and film. The model pictured on this page employs plates, the movement of the plates being regulated by the gun trigger. Such speed can be obtained with six plates, it is said, that a perfect panorama can be obtained by swinging the camera.

The lens in the new camera was made by the Bausch & Lamb Optical Company, and the glass for the lens was turned out in the company's own furnaces. This is regarded as conclusive proof that the homemade lenses are fully as good as those formerly imported from abroad and particularly from Germany.

(*Continued from page* 149)

ment and of this committee, or, if this is not approved, additional territory adjoining the War Department site can be obtained for these purposes.

The committee strongly recommends that the activities of the War and Navy Departments and of this committee on these lines should be carried out in as close proximity as is possible, to their mutual interest and the advantage of the Government.

The site contemplated by the Army is on a branch of the Chesapeake Bay, sufficiently remote from the entrance of the bay to insure reasonable immunity from interference due to the operations of a possible enemy. The location is such as to be readily accessible to Government officials located in Washington who have the direction of the important developments contemplated. It is also reasonably accessible to the principal manufacturing centers of the East, and therefore to the principal manufacturers who are interested in the production of the devices necessary to the War and Navy Departments.

The climatic conditions are temperate and well suited to the purposes intended, permitting of work all the year around. The location is also such as to afford unusual facility for the development of aircraft and their accessories suited to work on land and water under nearly all conditions which must be met in service. This feature alone makes it very desirable from the point of view of both the War and Navy Departments, as the development of aircraft suited to operation from rough water is one of the most important problems requiring solution in both services.

The committee feels that if the activities of the War and Navy Departments and of this committee can thus be concentrated at or near one station the greatest good will result, and therefore recommends that in the legislation for the War and Navy Departments and for this committee everything that would tend toward the accomplishing of this concentrated effort be given the most careful consideration.

FOREIGN NEWS

FRANCE

The Lafayette Flying Corps, composed of American aviators and commanded by two French officers, Captain Georges Thenault and Lieutenant de Laage de Meux, has shot down thirty German airplanes, according to a recent semi-official communication. Sergeant Raoul Lufbery has accounted for six, Sub-Lieutenant Bert Hall for three and others for one each. The late Sergeant Norman Prince shot down two and the late Sergeant Kiffen Rockwell two.

Speaking of Sergeant Rockwell, who had the honor of bringing down the first victim of the American squadron, Captain Thenault said: "Rockwell scarcely gave his helper time to fill the gasolene reservoir between flights. He was always where the German machines were thickest. Over Vaux and Douamont (in the battle of Verdun) he forced many of them to land behind their own lines to escape him."

The Lafayette Corps appears from this communication to have participated in the severest battles of Verdun and the Somme, contributing largely to the security of French aviators by relentlessly pursuing German machines and mastering the air over the fields of battle, thus enabling the observation pilots to regulate the fire of the French artillery. It was the Lafayette Corps which escorted the squadron that bombarded the Mauser rifle works at Obendorf, in the course of which there were numerous engagements, three German machines being brought down.

Sergeant Lufbery, with six German machines to his credit, is now rated among the expert aerial fighters.

GERMANY

The official report of Germany, issued April 8th, says that 161 Allied aeroplanes were lost in the month of March. The report follows:

"Our opponents, including Americans who were in the French aerial service long prior to the American declaration of war, lost in the month of March, in the west, east and the Balkans, 161 aeroplanes and 19 captive balloons by our attacks and anti-aircraft devices.

"Of these, 143 aeroplanes and nineteen balloons were shot down by fire from the ground. The German losses amounted to forty-five aeroplanes. No captive balloons were lost."

(According to this statement, the Allies lost only eighteen aeroplanes in air fights in March, while the Germans lost forty-five from all causes. The Allies have contended that the Germans seldom cross the battle line where their anti-aircraft guns could get at them, while the very number claimed by the German anti-aircraft guns—far more than claimed as shot down in air fights—shows the Allies must have been constantly above the German lines.)

GREAT BRITAIN

London, April 8.—A despatch to the *Daily Mail* says:

"The latest aeroplanes on both sides are of quite breathless speed. At one moment aeroplanes swish over you like a covey of birds. At another you see or hear no sign of their presence. A minute later faint mysterious sounds as of hammering on soft wood come from the heights and then one of the planes, either winged or too weak for combat, dives for harborage within its own lines.

"The fighting is now so quick and skilful that the slower, older machine has about as much chance as a sparrow against a hawk. All records were broken by one of the newest and fastest British machines which destroyed five of the enemy in one flight.

"The art of high diving has increased beyond telling. From 16,000 feet, where they are scarcely visible, or from the ambush of a cloud, planes come down like a plummet to bomb a train, to fire a balloon or to riddle a body of men with machine gun fire. Firing at small objects is daily practiced. So quickly do the divers come and go that men with loaded rifles on the very spot are often in their astonishment too slow to fire till the plane is well out of range. The German authorities complain bitterly that their infantry fail altogether to use their rifles on such occasions.

"The Germans have concentrated a number of their best airmen, just as earlier they concentrated a group of their best gunners, in which is known as a 'traveling circus' which gathers wherever they meditate an offensive. It is a mobile unit of expert fighters and photographers."

April 8, 1917, will be marked as being probably the day of the most furious aerial activity of the great war, and a day that established the superiority—temporarily at least—of the British airmen over those of the Central Powers. The full report follows:

With the British Armies in France

April 8, 1917.—Under a blue Easter sky, beflecked only here and there with bits of filmy white cloud, British aviators by the hundreds continued today their work of re-establishing beyond all question of doubt their supremacy in the air. They carried the fighting wholly into the enemy territory, sought out their aerodromes, military headquarters, ammunition dumps and concentration camps and challenged the Germans in every possible manner to come up and fight.

50 Miles Behind German Lines

In one instance the British flyers penetrated fifty miles behind the German lines. They fairly flew circles about a numerically superior enemy squadron which sought to intercept them.

To the laymen the weather seemed ideal for flying, but the airmen were inclined to complain because some of the woolly patches of cloud had enabled several hard-pressed German aviators to take refuge in their mist and escape immediate punishment.

"Give us three or four cloudless days and we will hit the Boche airmen such a blow that they won't be able to recover all summer," said an enthusiastic wing subaltern today.

The loss of twenty-eight machines in two days' bombing, fighting, photographing and observing is counted by the airmen as a small price to pay for the work accomplished, considering the number of machines engaged, coupled also with the fact that all these operations were within the German lines.

Against the loss of the British machines must be placed fifteen German aeroplanes, actually seen to crash down and thirty-one driven down damaged, most of which are believed to have been destroyed. The British will not officially announce a hostile machine destroyed unless two or more of their flyers actually see the falling plane ablaze or watch it crash into a hopeless mass of wreckage.

When flyers are engaged in fighting the formation is twenty or more machines, and when one begins to go down there is seldom time to watch the completion of its earthward journey. Under such conditions a hostile machine is not counted in the total enemy casualties. However, the British Flying Corps is absolutely unperturbed when its losses exceed those of the enemy. The men philosophically regard this as the penalty necessarily entailed in maintaining the offensive. Technically, the Germans seldom have a machine "missing," for with the fighting going on almost entirely on their side of the line all their machines driven down can be accounted for.

There is no comparison with the amount of work done by the British and German machines. To airmen maintenance of supremacy means ability to ascend daily and accomplish whatever aerial work is desired. Although the Germans have been more active in recent weeks, they have never interfered at any time seriously with this work. In bad weather, in which the British are unable to harass them, the Germans generally start prying over the British lines. Two days of fighting generally discourages them, however, to such an extent that the British believe a solid week of fighting weather will disarrange their flying plans for months to come.

The British have a great preponderance of machines, and at least thirty of these probably go over the German lines against one hostile machine flying on this side of the trenches. This ratio of activity within the enemy territory must always be set against the ratio of losses. The maintenance of a great number of machines enables the British to carry on a preponderance of artillery fire, directing their shots, not by hazard or "off the map," but under the actual eyes of the aeroplanes.

The constant aggressiveness of the British Flying Corps and the willingness of the splendid young pilots and observers to take every manner of risk means information for and protection of the army on the ground to an extent which they regard as amply repaying their sacrifices. Under their guidance on this Easter Day the British guns were roaring all along the far-reaching battle lines. It was a brilliant day for warfare as well as air fighting.

Such a day develops incidents beyond measure. Planes could be seen darting in and out of fleecy cloud banks, glinting at times like bits of silver in the sunshine and flashing away with the speed of a sunbeam itself. The distant patter of machine guns often told of fighting behind a cloud screen or at such a height that the machines were lost to view.

The task of suppressing German airmen is greater today than it was a year ago, but the British have set about to accomplish it with all possible speed.

JAPAN

The following reports are from *The Far Eastern Review*:

Japan Buys Aero Motors for Russia

Through the New York office of Mitsui & Co., the Russian Government has placed a huge order for aeroplane motors. These motors are being built by the Hall-Scott Motor Company in Berkeley, California. M. Yasumoto, a young Japanese engineer attached to the New York office of the Mitsui company, quietly went to San Francisco several weeks ago, tested the Hall-Scott motors, gave them a technical verdict, and is now supervising their construction at the rate of about two a day.

It is understood that the Russian Government is paying approximately $1,500 apiece for the engines and that the contract totals several hundred thousand dollars. The motors are shipped as fast as they are completed, the planes being built in Russia.

Yasumoto admitted that the contract was a large one, but refused to give the exact amount. It was learned that the placing of the order followed an unsuccessful attempt of the United States Government to procure a 400 horsepower motor for six huge, double engine planes. Silas Christofferson and other aeroplane builders were consulted in this quest but none could deliver the motor.

Japanese Aviators in China

Four Japanese aviators are now engaged to instruct the Chinese to fly at Tsingtao. They are aviators Sakamoto, Hoshino, Kumagi and Tachibana. Of the four, Sakamoto and Hoshino are wearing the uniform of major general and the other two that of colonel.

Every day they are giving instructions to the Chinese students, but as the aeroplanes they brought from Japan are not set up yet, they are only teaching their students the primary construction of aeroplanes.

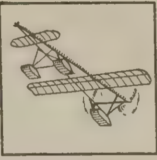
Two aeroplanes are at the aviation field ready to be set up, and it is expected that the three machines of Mr. Y. Ozaki will soon reach

Japan's Aviation Programme

Japanese Military Aeronautics Investigation Commission which succeeded in the construction of aeroplane-destroyers and armored aeroplanes has under scheme the construction of a huge aeroplane with accommodation for a crew of eight. Another plan for the construction of an armored airship together with the establishment of the Military Aerodrome No. 2 is also under way. The armored airship will be modeled after Zeppelin airships with a length of 130 feet and a capacity of 20,000 cubic metres for its balloon, and will be equipped with four 300 h.p. motors capable of continuing an aerial cruise for thirty hours at a speed of 20 metres per second, with a crew of twenty and 200 *kuan* (1,666 pounds) of explosive. The new airship is to possess double the fighting power of the *Yuhi*. As previously reported, the new aerodrome is to be laid out in Kagamigahara (Gifu Prefecture). A hangar and an aircraft building yard will be reared. The surveys of the proposed site have already been finished. Owing to the financial consideration, the completion of the whole work in the coming fiscal year is thought doubtful.

MODEL NEWS

Edited by G. A. Cavanagh



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MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Power Driven Paper Models

Mr. H. Major, an enthusiast on paper models, is responsible for the following report:

"Small paper aeroplanes, complete with rubber motor, 5-inch carved propeller, etc., turning the scale at a quarter of an ounce, are able to travel with perfect stability and certainty distances up to 300 feet in a straight line.

"During the past three and a half years I have constructed well over one hundred of these small scale models, meeting with such success that, upon occasion, I have been surprised myself by the performances of a new type. Indeed, I have no hesitation in saying that far more may be learned by an amateur of the essential conditions of flight by the use of these models than by the construction of a limited number of larger machines, the analysis of which is necessarily more complicated. An exhaustive study of the whole principle of aerostatics may be undertaken with the practical certainty of the deductions made being accurate in a high degree.

"There is no type of aeroplane existing of which it is impossible to make a small scale model with success. Tractor biplanes, propeller biplanes, with the screw revolving within the compass of the outrigger, and even scale copies of the old type Maurice Farman (here the tail booms are set farther apart so as to allow the use of a larger propeller), may be built to cover distances in proportion to the speed and design.

"Naturally an amount of time must be spent in perfecting details and adding refinements. For instance, it took me three months to design a really efficient propeller bearing, but then that bearing was standardized, and I have used no other pattern for three years. Also, a piece of folded paper is not an efficient, or even a strong, substitute for cross-braced interplane struts, and the use of such would radically affect the design of any model. It must be emphasized, however, that the greatest care must be taken in designing the model.

"The propeller, as an example, should be carefully carved so as to comply with the laws appertaining thereto. Do not when making a highspeed model fit it with swept-back wings under the impression that you are decreasing head resistance. This only serves to slow the aeroplane. It would be interesting to hear some correspondent's views upon this subject. The following few notes may be of assistance:

"In designing the first model choose a tractor monoplane.

"See that the wings have a good upward dihedral angle.

"Fit a screw of ample size.

"See that you allow sufficient stabilizing surface in the rear.

"The tail should be placed the greatest distance possible in the rear of the wings, and in most cases set at a slight negative angle.

"Do not use cardboard or drawing paper anywhere in the construction of the model. A hard bank paper is best with a smooth surface. Substance about 18 to 20 pounds demy.

"Make use of an adequate camber in the planes. A good all-round form is the following: Strike an arc two-thirds of the length of the required chord, and complete the line at a tangent. Vary the radius of the arc in proportion to the camber required.

"Construct the wings scientifically. One form is to use one thickness of paper, overlapping the leading and trailing edges, and then glue these down over two very thin can spars.

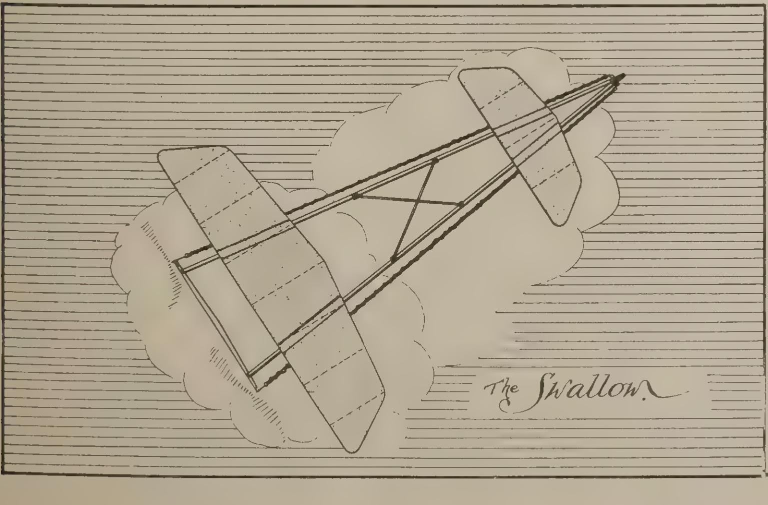
"Do not use gum or paste of any description. An adhesive such as seccotine is the most satisfactory.

"I may mention in conclusion that it is not unusual for these miniature aeroplanes to attain a height of 20 to 30 feet, and special looping models may be constructed with success."

Notice

Information has just come to hand that a new Model Club has been formed in Baltimore, and will operate under the name of the Broadway Model Aero Club.

We would suggest that all model flyers in the vicinity of Baltimore, desirous of furthering the sport, get in touch with the secretary, 927 No. Broadway, Baltimore, Maryland.



The Swallow—Drawn by Mr. Harry G. Schultz, representative of the Standard type pusher, rubber strand driven racing type model which has played such an important part in the history of model aeronautics and which is gradually being replaced by the more efficient scale type model. For a complete description see Volume III, No. 12.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

The Solar Seven

Invented and vouched for by the inventers of the Odor-Engine, and the Accordion-Plane. Registered in the Siamese Patent office. Fully protected in the United States by the Pinkerton Detective Agency. Price on application. Note: those buying in quantities will be charged a higher price, for if they can afford to buy a lot at once, they can afford to pay a good price for them. Because of the grave crisis which has been confronting our nation we have held back the announcement of this, our latest and greatest, invention. We thought for a while that there was a possibility of the Government buying the invention, and paying us a few million dollars for it, but since they have shown no signs of doing so, we present the description in this issue. We would have drawings but the artist who usually draws for us refused absolutely to do the job. He wanted more money, and we offered to pay him just what he was worth, but he said how did we expect him to live on that, and resigned in disgust. So we ask our readers to please use their imaginations, and imagine the completed engine in all its pristine glory.

Reel One

The Solar Seven, as may be surmised from the name, acts upon an entirely different principle. (So far our principal is limited, but we expect soon to sell stock). As the old Romans used to exclaim when viewing something marvelous in the way of inventions, *‘ab usque tandem, in fortitier derogatory.”* We are quite sure that if one of the old Romans could see our engine, he would make an even more rash exclamation. Notwithstanding.

The Solar Seven acts upon the principle that when the sun shines, it gives forth light, which light is dispersed in radially cogniscent segments, which segments may be said to be equal, each to each, in a ratio of five to one, with a remainder of $4.62 for error. Of course, we realize that this is directly opposed to Pascal's Law of Primo Geniture, but on the other hand, Pascal knew absolutely nothing about the law of obtaining money under false pretenses. Therefore, while acknowledging his many contributions to science and literature, we must state that we are starting out on new and unexplored fields, and we shall be governed by nothing except the laws of New York State, and the condition of our treasury. We have adopted for our business slogan the old saying of the Mosaic, —or Archaic—Cliff Dwellers; "When the Principle is different, the fulfillment thereof is transitory."

Reel Two

The sun sends forth light, and being careless, does not watch it to see where it goes. We take advantage of this carelessness, and use the light for the sole power of propulsion in our engine. We have a reflector which catches the rays of light, and send them in two directions. The first bunch of rays is directed toward a glass box which contains ice. The light melts the ice and it trickles down a pipe into a retainer, in the form of water. Once in the retainer, the other rays of light strike it, and it boils. Now we know by our chemistry that when water boils it expands and travels upward in the form of steam. Now we lead the steam through a turbine, which turns the propeller of the aeroplane! Simple? Absolutely! (The idea is meant, not the inventor).

Reel Three

Now the question goes up as to what we will do when our ice gives out. There is where we are clever! After the water, —that is the steam—has passed through the turbine, and forced the aeroplane ahead we lead it to a refrigerator. Now we have an auxiliary fan on the upper plane, which is driven by the air when the machine moves through the air. This fan drives another fan, which forces a stream of cold air directly on the refrigerator. The water in the refrigerator becomes chilled, and freezes. We know that at the moment of freezing water expands with an irresistible force. So the water expands, and releases a trip, which lets an axe fall on the ice, breaking it up, as soon as it is formed. Now the axe bounds back from the impact of the ice, and in bounding turns a small paddle wheel, which sweeps the ice back into the original glass box, where the cycle of operation starts all over again.

Reel Four

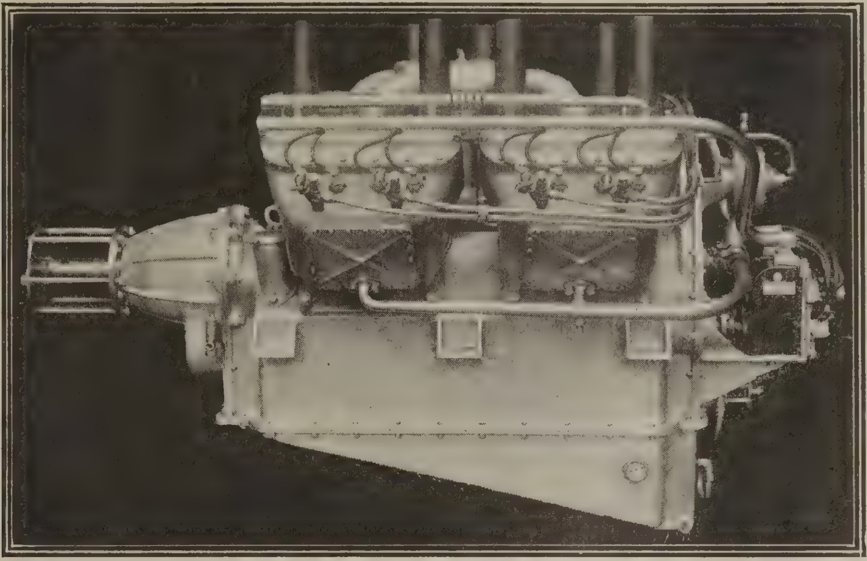
Now follows the most important point of all. Our machine, in action, weighs absolutely nothing! *Absolutely nothing!* "But why?" you ask impatiently.

"Listen," we return.

When the motor runs it turns another fan, and this fan has a lifting effect. The faster this engine runs, the faster the fan must go, and the more the entire machine must be lifted. In fact in a private test, conducted under the auspices of the State Board of the Absent Minded, it was found that when the machine goes at full speed, the weight of the engine must be reckoned in a minus quantity! With this solemn thought we leave our readers to gasp in admiration, and compose hymns in honor of the inventors of this, the greatest, grandest, and most garrulous invention ever conceived by the brain of mortal man. And when millions of our machines are in daily operation, just let it be said of us that we ever strove to improve the quality of our product, without losing any profit by it. We give our invention to the world. Whoever wishes to use it may do so without asking permission. (The royalty fee is one thousand dollars a machine).

WELL, HOW'S OUR YOUNG AVIATOR TO-DAY, EH?
FINE UNK! I WAS HIGHLY HONORED TO-DAY, I WAS!
TH' HEAD OF TH' AVIATION SQUAD CAME TO ME AN' SAYS "WE'VE JUST INVENTED A NEW MONOPLANE SOMETHING RADICALLY DIFFERENT! OF COURSE WE DON'T KNOW HOW SUCCESSFUL IT'S GOIN' TO BE —
— IN FACT WE DON'T KNOW WHETHER IT'LL EVEN FLY! THAT'S WHAT WE'VE GOTTA FIND OUT, SO WE'VE PICKED YOU TO TAKE IT UP AN' FIND OUT"
NOW, AIN'T THAT QUITE AN HONOR FOR ME?
OH SURE, SURE, QUITE AN HONOR! BUT I'D MAKE 'EM FURNISH TH' FLOWERS AN' MUSIC TOO!
POP—

Courtesy N. Y. Globe



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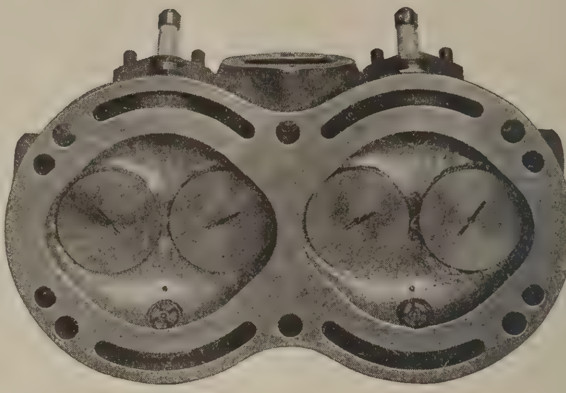

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The aluminum cylinder heads of the Sturtevant Aeronautical Engine are completely water-cooled with ample passages for unobstructed circulation of the cooling water around the valves. Cast iron valve seats are employed.

Overheated valves are an unknown trouble in the Sturtevant engine.

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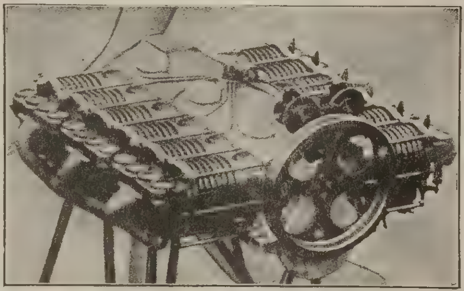

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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ARE NOW READY FOR THE MARKET
Patents allowed and pending.

They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
Ignition—High Tension Magneto.
Carburetor—Improved ASHMUSEN.
Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11½ Gals. per hour, Low Grade.
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Oil Consumption—105 H.P.—1¼ Gals. per hour, Good Grade.

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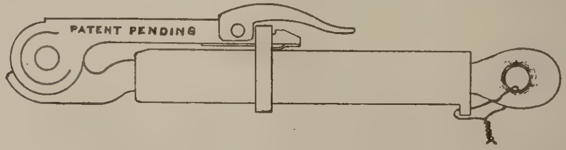
A Labor and Time Saving Invention

The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

From the description above given, the advantages of the *Bellanca Turnbuckle* over all other types will readily be seen and appreciated.

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The Massachusetts Naval Militia has the first one now in service.

Standard Deperdussin control in duplicate; Curtiss OXX-2 motor; simple float; light, sturdy construction; large speed range (forty to sixty-eight miles per hour); are characteristics necessary to the hard service required for training purposes.

Hydroplanes and pontoons designed and manufactured for airplanes of every type, including Curtiss, Sturtevant and other makers.

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HALL-SCOTT MOTORS are offered to reputable aeroplane manufacturers as possessing those refinements in design and construction, together with consistent power delivery, under actual flying conditions, points of merit which are of absolute necessity to permit of meeting Government requirements in flying tests of the aeroplane.

HALL-SCOTT "BIG SIX" Motors, Types A-5 and A-5a, 125-140 H. P.

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The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

The Buck Aircraft & Munition Co., Inc.
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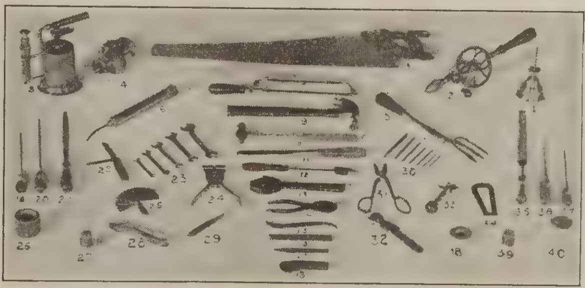
A Pilot's Necessity



THE accompanying illustration shows the compactness and completeness of the Cooper Aeronautical Tool Box. With the assortment of tools shown the weight is only 44 lbs.—usually 60 lbs. are allowed for tools on Military machines.

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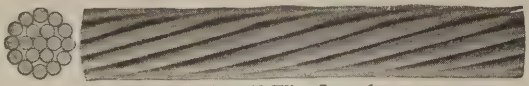

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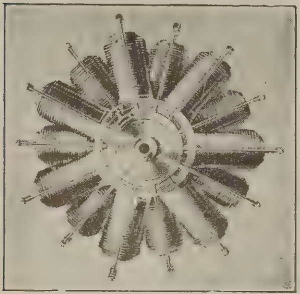

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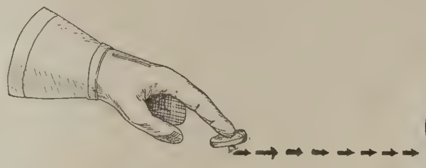

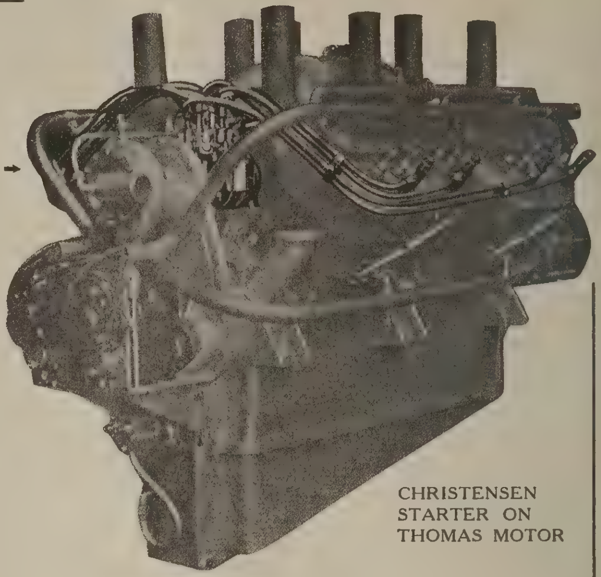

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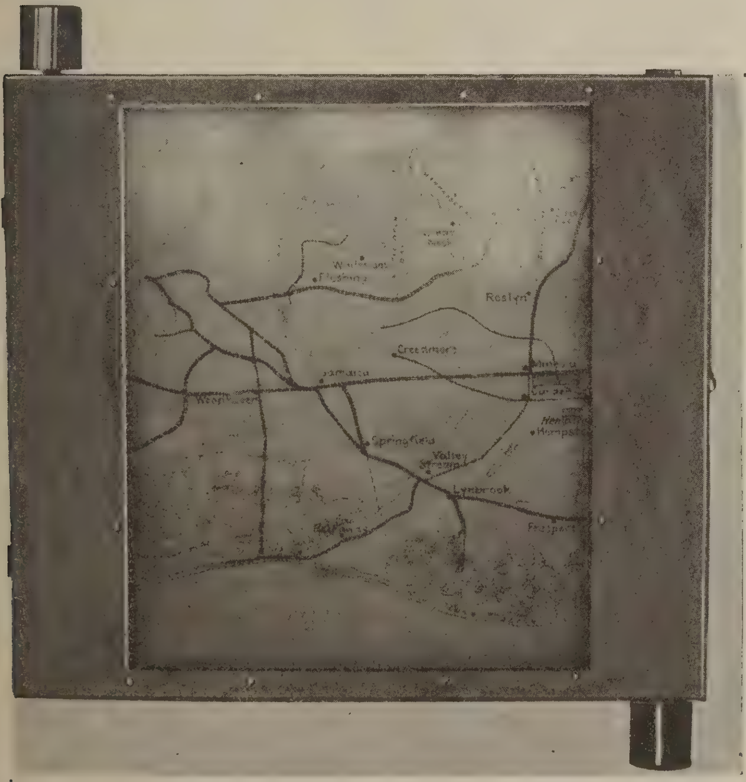

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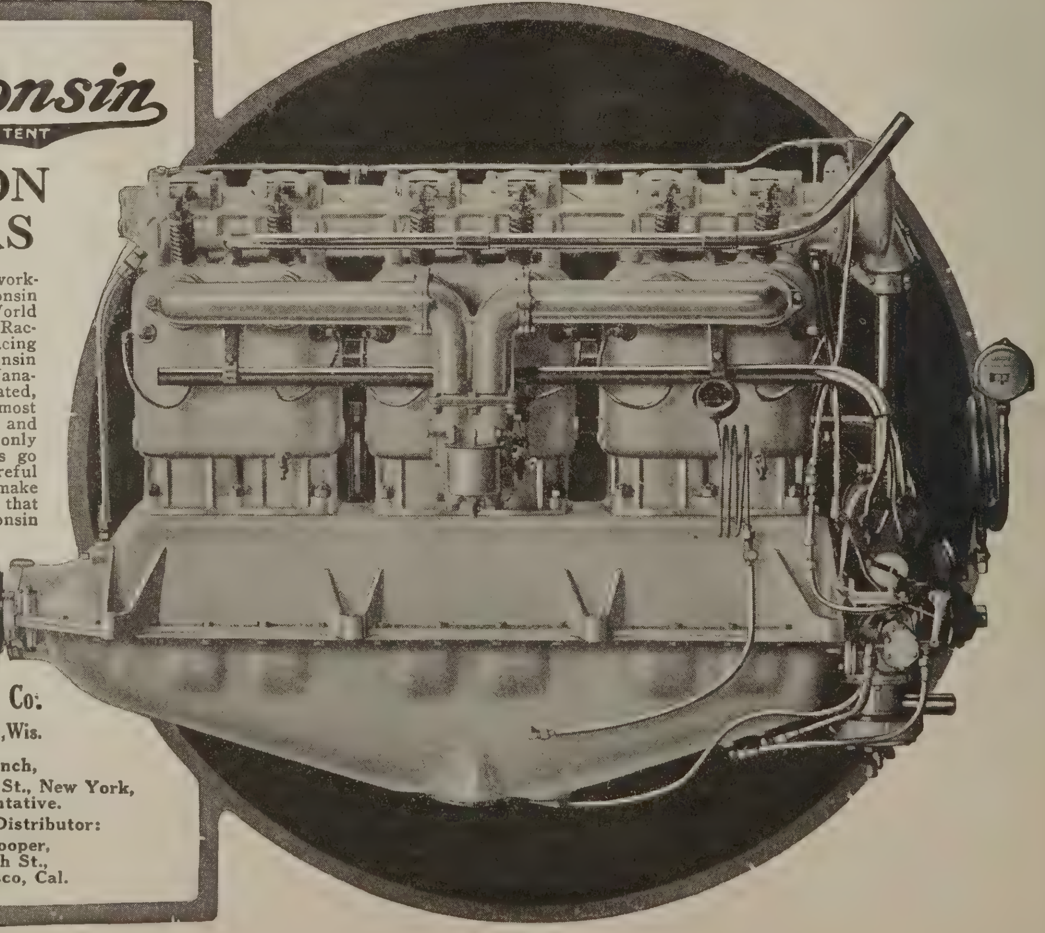

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A Lewis Machine Gun in action against
a hostile aeroplane*

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Major-General LEONARD WOOD: "The Lewis gun has been adopted practically unanimously as the light gun of the British service and is being built for the French; and I think it is safe to say, when you see great nations struggling for life adopt a gun, that they are not adopting it lightly."

*Transcript from the hearing before the U. S.
Senate Military Committee, January 31st, 1917.*
From Army and Navy Register

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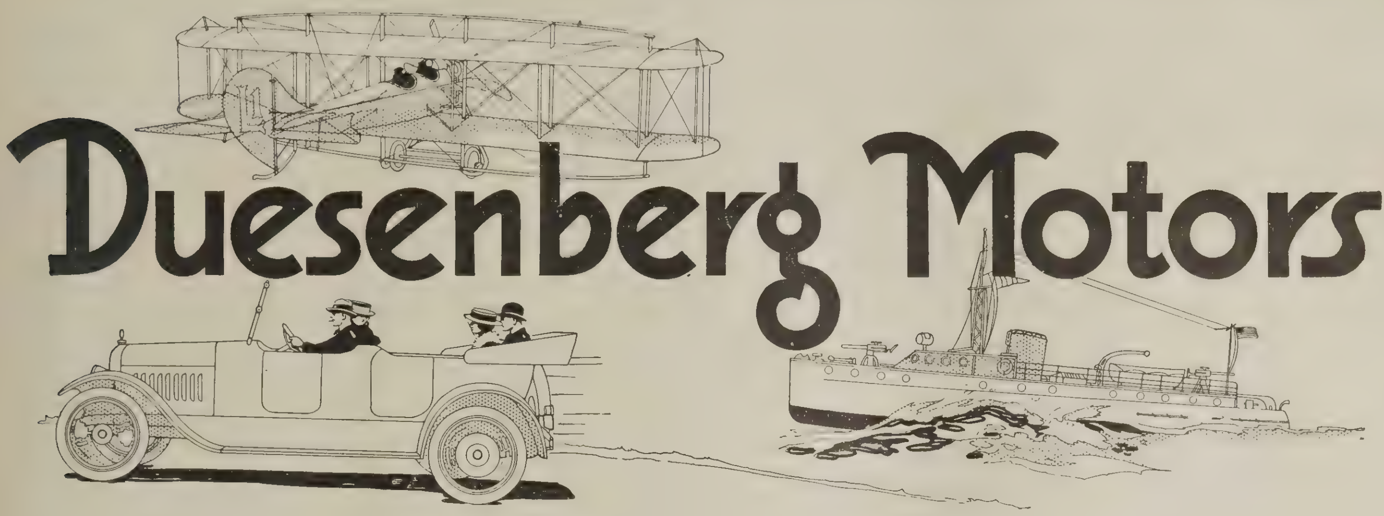

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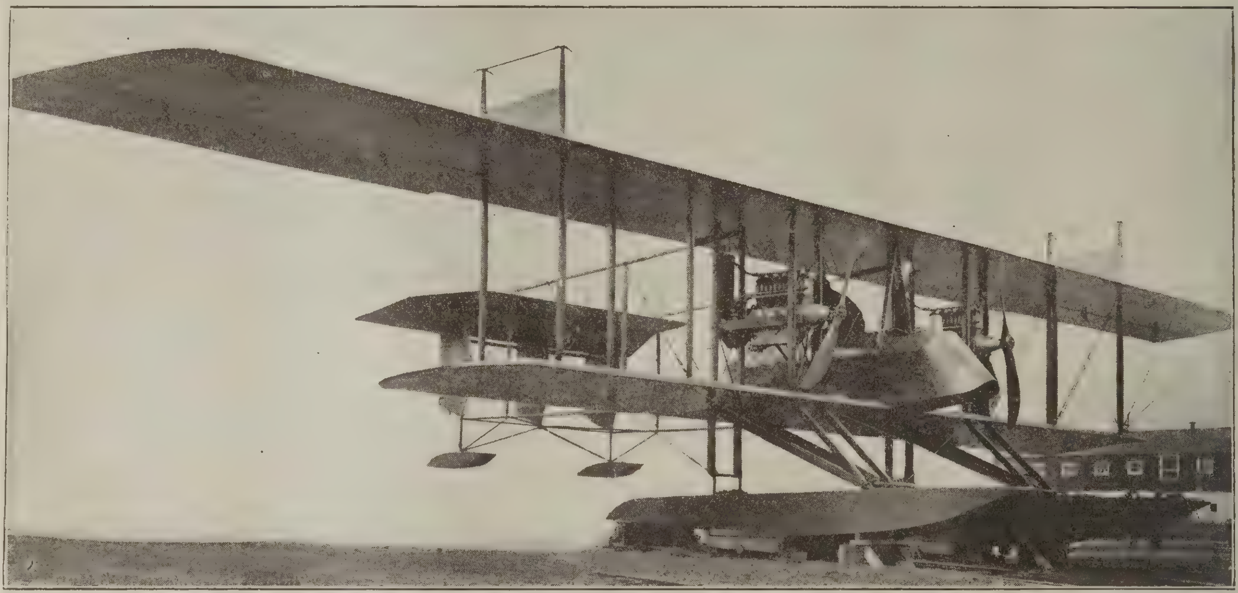

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WEEKLY

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VOL. V NEW YORK, APRIL 23, 1917 No. 6

$120,000,000 FOR AERONAUTICS

APPROXIMATELY $120,000,000 is to be spent in army and navy aeronautics. The army "war budget" sent to Congress includes an estimate of $54,000,000 for aeronautics and $6,000,000 additional for personnel, etc., for the Army Air Service. The estimate for naval aeronautics is similar to the army's.

The National Advisory Committee on aeronautics advises a plan to train 2,400 aviators in the first year of the war, which ends April 1st, 1918. At least three thousand aeroplanes are to be ordered to carry out this plan.

High ranking officers from the French and British air services are being "loaned" to the United States and will assist the army and naval authorities in organizing our air services.

AMERICAN AEROPLANES ARE EQUAL TO THE BEST EUROPEAN PRODUCTS OFFICIAL REPORT STATES

THAT type for type American aeroplanes are equal to the best European products, and that American fighting aeroplanes have a factor of safety of six, whereas European machines have only a factor of safety of three—are facts brought out in the official report of an investigation made by the Advisory Committee on Aeronautics, of which Mr. Alan R. Hawley, the president of the Aero Club of America is chairman, and which is cooperating with Rear Admiral Nathaniel R. Usher, the Commandant of the Third Naval District, in the organization of the Naval Reserve Forces.

The results of this investigation form part of a detailed plan dealing with the aerial defenses needed for the Third Naval District, which extends from New London to Barnegat, particularly the aerial protection of shipping and the employment of aircraft for submarine hunting. This plan is withheld from publication for obvious reasons, but the results of the investigation is made public. It reads as follows:

Report on the Efficiency of American Aeroplanes

"Regarding the efficiency of American aeroplanes, our Committee has investigated the subject and has found that, type for type, American manufacturers supply aeroplanes equal to the very best European products. An investigation of statements of people who, on their arrival to this country from Europe, state that American aeroplanes are not used at the front in Europe has brought out the fact that the aeroplanes ordered in this country so far with the exception of our large seaplanes, which are superior to any European product, have only been the training type. A further investigation has shown that the reason why only the training type of aeroplane have been ordered in this country by the Allies is that the limited production in this country in the past two years did not permit deliveries of thousands of aeroplanes and it would have been most inefficient to send to the front a few hundred aeroplanes of a type for which spare parts were not available. This inability on the part of American constructors to deliver aeroplanes by the thousand at the time when the Allies needed the aeroplanes most made it necessary for the different countries to create their own sources of supplies for the bulk of the aeroplanes needed by them. The complaints from the representatives of different countries which have ordered aeroplanes in the United States are entirely of our limited output. They state that they could use thousands of additional aeroplanes of the training type—as well as of the remarkably large seaplanes which are not obtainable elsewhere outside of the United States.

"These facts are substantiated by the fact that additional orders have been placed continuously in this country for aeroplanes and aero motors.

"The Committee's investigation shows that all the reports regarding the alleged inefficiency of American aeroplanes and motors are based on the fact that close to two years ago, when it was almost impossible to get the suitable metals for crankshafts, a shipment of American motors proved to be unsatisfactory and the motors had to be reconstructed in England. But the investigation also shows that the Allies had the same trouble at the time with British and French products. These facts were brought out by the recent investigation of the Royal Flying Corps of Great Britain.

Investigation of the Efficiency of American Fighting Aeroplanes

"Our investigation shows that the statements made recently, to the effect that American fighting aeroplanes do not have the speed and climbing ability of foreign fighting machines, is based on the fact that in America we demand a factor of safety of six, whereas foreign machines only have a factor of safety of three. Likewise, whereas foreign countries accept machines that land at a speed of close to 100 miles an hour, in the United States we expect our fast aeroplanes to land at a speed not exceeding 60 miles an hour. Considering that we have a factor of safety twice as large as the foreign machines and that we have a landing speed not exceeding 60 miles an hour, our fighting machines compare favorably with the foreign machines in speed. We get a speed of approximately 130 miles from our machines while the European machines, with the lower factor of safety and greater landing speed, get only about ten miles more."

Almost simultaneously with the publication of the above report there were published in various publications information from European sources which shows that this report is based on actual knowledge of inside conditions existing in Europe as well as in the United States. The account of the death of Norman Prince, at the end of the raid on the Mauser works, for instance, shows that the Nieuport fighting machines only carry fuel for two hours, and land at a speed of about 100 miles an hour. The factor of safety of a Nieuport is supposed to be less than 3, it having been cut down to increase the speed. This was logical, because the factor of safety is not of any use if the aviator risks being shot by the faster enemy aviator.

But who will dare to propose to the United States Army and Navy authorities to cut down the factor of safety to 3? If a death should follow the cutting down of the factor of safety the person who proposed it would feel that he assumed more responsibility than one can assume so long as we do not have to fight enemy aircraft off the American skies.

It will, of course, be different when we decide to send aviators to Europe. Then they will have to be trained on the fastest machines obtainable. In the meantime they can be trained on machines having a speed of up to 120 miles an hour. Thorough training on these, and training on aerial gunnery, will fit them for the intensive training to be taken before actually going to the fronts.

There are at present two Nieuport machines in the United States, purchased by the U. S. Government. We shall await their tests with interest. The tests of the Vickers speedster at Governor's Island have been interesting, but the average of breakage on landing has been extremely large, so far.

The statements made in the British Parliament also give evidence that some of the claims made for foreign machines are not borne out by facts. On March 13, for instance, during a long discussion of certain conditions existing in the Royal Flying Corps there was brought out that a speed of 117 miles an hour, was considered extraordinary and members of Parliament demanded an inquiry to find out why the military authorities had not ordered machines of that type.

In connection with a statement made by the British Under Secretary of State for War Macpherson, regarding the average casualties per week in the Royal Air Services during the preceding six weeks, Mr. Billing, a member of Parliament, made the following statement:

"I would like to suggest to the honorable gentlemen on the Front Bench that the majority of these fatalities can be directly attributed to machines being sent up in which I said twelve months ago that our men were being murdered. I stand here twelve months later, and I say even on this very day that men are being murdered by being sent up in these machines. Our men are today being sent up in BE2 gun spotting. These machines are utterly incapable, armed and equipped as they are, of rising over 5,000 feet. They are sent up with two 20 lb. bombs, and two guns fitted on them. The guns, however, are not adequately fitted for fighting. These machines are sent six miles out into the enemy's lines. Only recently I had two or three cases brought to my notice of men sent out gun-spotting, and with them they had two of what are called chasing machines, but they lost the chasing machines, they stopped over the lines at the mercy of the German airmen, and they were eventually shot down. Quite recently, two fell in flames in our own lines. We have machines faster than any of the Germans have at the front at the present time."

We know, of course, that the Spad is a good machine. But we also know that it is also limited to carrying fuel for two hours, landing at a speed of not less than 80 miles an hour, and has a factor of safety of about 3. We feel certain that American manufacturers can build machines having the speed of the Spad if the other requirements are to be as obtained in the Spad.

The Advisory Committee on Aeronautics, cooperating with the Commandant of the Third Naval District in the organization of the Naval Reserve Forces consists of:

Alan R. Hawley, Chairman; Captain Robert A. Bartlett, Howard S. Borden, August Belmont, W. Earl Dodge, F. Trubee Davison, William Dubilier, F. C. G. Eden, Rear Admiral Bradley A. Fiske, Frank Guggenheim, Congressman Murray Hulbert, of New York; John Hays Hammond, Jr.; J. F. Knapp, Rear Admiral William N. Little, Frank N. Leavitt, Congressman F. H. La Guardia, of New York; Robert A. Lovett, Augustus Post, Rear Admiral Robert E. Peary, Harold Irving Pratt, Lawrence B. Sperry, Lewis S. Thompson, Eugene S. Willard, Evert Janson Wendell, Charles Elliott Warren, Schuyler Skaats Wheeler, Henry Woodhouse.

REPORT ON AERIAL DEFENSES NEEDED FOR FIFTEEN NAVAL DISTRICTS MADE CONGRESSIONAL DOCUMENT

The remarkable report, explaining in detail the aerial defenses needed for the fifteen naval districts, which was drawn by the Advisory Committee on Aeronautics co-operating with Rear Admiral Usher, the Commandant of the Third Naval District, has been made a Congressional document and was printed in the *Congressional Record* of April 13.

Congressman Murray Hulbert in presenting the report to Congress paid a much deserved compliment to the Aero Club of America and the patriotic men who have given their time and funds to developing our aerial defenses.

By stating the coast aerial needs of the naval districts this report gives a valuable base for the aeronautic industry and those interested in aerial preparedness to work on.

Copies of the report, which covers eight printed pages, can be had by applying to AERIAL AGE, 280 Madison avenue, New York.

The Advisory Committee that prepared this report consists of Alan R. Hawley, chairman; August Belmont, Howard S. Borden, W. Earl Dodge, Rear Admiral Bradley A. Fiske, retired; Rear Admiral Robert E. Peary, retired; Frank Guggenheim, F. Trubee Davison, Capt. Robert A. Bartlett, Congressman Murray Hulbert, Congressman F. H. La Guardia, Lawrence B. Sperry, William Dubilier, John Hays Hammond, Jr.; J. F. Knapp, Rear Admiral William N. Little, retired; F. C. G. Eden, Robert A. Lovett, Augustus Post, Harold Irving Pratt, Lewis S. Thompson, Eugene S. Willard, Evert Jansen Wendell, Charles Elliott Warren, Schuyler Skaats Wheeler, Rodman Wanamaker and Henry Woodhouse.

This committee has actually taken steps to establish ten seaplane stations in the Third Naval District, and is co-operating in forming units of the Aerial Coast Patrol. About 200 men connected with different units are under training or about to take up their training.

Eyes Above.

[Editorial in the *N. Y. Globe*.]

British eyes searched the German armies last Saturday (April 7) with a thoroughness that must have chilled any hopes General von Hindenburg has cherished of a fresh surprise, whether backward or forward. His "trimphant" retreat was ascribed to his ability to put the enemy's eye out. The fliers that brought back seventeen hundred photographs of his positions and dropped eight tons of dynamite where explosions are least wanted should enable Generals Haig and Nivelle to forestall his next move, if they want to do so.

How important this extraordinary aerial reconnaissance actually was in observations made and German aeroplanes destroyed we have no present means of estimating. The operations of the men who do their work on and in the earth may soon give us a clue to the practical value of the information obtained. No knowledge of confidential reports is needed, however, to disclose the enormous advantage possessed by armies equipped for such work. The most untutored civilian can judge something of the difference between total ignorance of what your enemy is doing and such complete knowledge of his dispositions as may be gained by swarms of peering airmen provided with tell-tale cameras.

Most American military men know that we have thus far done little or nothing to qualify us for jobs of this kind, though we were the first to get men into the air for practical purposes. If we are to raise a real army we must not long delay what has to be done for the air service.

For a Department of Aviation.

[Editorial in *Philadelphia Inquirer*.]

Senator-elect Caldwell, of New York, announces his intention of introducing a bill at the forthcoming session of Congress creating a Department of Aviation, to be headed by a new Cabinet officer, who shall take complete charge of the aviation service of the country.

The point may be made that there is no aviation service for the proposed Secretary of Aviation to take care of, but the answer is that the demand will soon create the supply. This suggested departure is in line with the campaign which has been so vigorously prosecuted by Admiral Peary for the last six months, and if carried out would help to put the air service of the Nation upon a substantial and respectable basis.

No important nation on earth is so poorly equipped in the matter of flying machines as the United States. Now that we are actually preparing for war, it becomes necessary to provide such equipment, and experts are of the opinion that it can be best done by the creation of a new department. Admiral Peary is confident that with the proper encouragement we can get the men and the machines. He feels that there are thousands of young men in this country who can be taught to handle an aeroplane as well as a chauffeur handles an automobile. With the men and the machines, a comprehensive aero coast defense system could be established along the seacoast. Finally, the Admiral believes that we would have an industry developed which would be to the air service what Krupp is to Germany and Bethlehem to the United States in their fields.

It is to be borne in mind always that this work of air preparedness is not merely for the present German danger, but for the future. We have been stimulated to activity in all lines of defense by the crisis which confronts us, but it must not be forgotten that we are building for the future as well as the present. We seem to have learned our lesson, but it will not be much good unless we look forward. By preparedness alone can we insure ourselves against the dangers of invasion.

The News of the Week

Willys-Overland to Build Curtiss Motors

Buffalo: The order under negotiation by the Curtiss Aeroplane & Motor Corporation with the Willys-Overland Company for 4,500 Curtiss motors for use in aeroplanes is indicative of tremendous volume of orders which this Government is placing and will place to fill its requirements for the air service.

It is further significant that the Willys plant is willing to turn its excess capacity over to construction of aeroplane motors through the medium of the Curtiss organization, which latter corporation will probably be the major factor in the equipping of the aerial departments of the army and navy.

For the last two years the Curtiss plant has been turning out large numbers of aeroplanes and motors for foreign governments. At present this company has about $12,000,000 worth of orders on its books exclusive of any Government orders placed during last week—production is at the rate of about $1,000,000 worth a month, but this output can speedily be increased.

Standard Aero Corporation Supplies Brazil With Hydros

New York: The Standard Aero Corporation of New York, in a communication to Aerial Age, announces that it has sold three twin-motored Model D-2 hydroplanes to the Republic of Brazil.

The purchase of these machines was made by Consul General H. C. de Martius Pinheiro of Brazil, upon recommendation by a Naval Commission consisting of Capt-Lieutenant Luiz A. Graca, and Lieutenants Raul Vianna Bandeira and Victor de Carvalho Silva. The latter two are experienced naval aviators while Capt.-Lieutenant Graca is an ordnance expert.

The three twin-motored hydro-aeroplanes are of the same type as those ordered by the United States Army for coast defence purposes, each being equipped with two Hall-Scott A-5 motors with a very complete service equipment consisting of aeronautical inplements, Sperry bomb sight and dropper, Sperry wireless equipment with a sending radius of 25 miles, Herbert and Huesgen aero cameras.

The Holsam Company, Inc., who were the agents for the order in this country, are remarkably well equipped for handling aeronautical lines in South America as they have had a large experience in the export of machinery and various mechanical appliances and are furnishing several of the South American Governments with vast quantities of supplies yearly.

Joseph P. Knapp Presents Seaplane Station

To facilitate the Aerial Coast Patrol for the Third Naval, Mr. Joseph P. Knapp, President, American Lithographic Company, and a director of the Metropolitan Life Insurance Company, presented to Rear Admiral Nathaniel R. Usher, the Commandant of the Third Naval District, a seaplane station, with hangars and receiving wireless station, located on his property at Mastic, on the south shore of Long Island. The offer was made through the Advisory Committee on Aeronautics, of which Mr. Alan R. Hawley, the President of the Aero Club of America, is the chairman; and recently a committee consisting of Messrs. Alan R. Hawley, Rear Admiral Bradley A. Fiske, Henry Woodhouse, Clinton Davis Backus, the organizer of Aerial Coast Patrol Unit No. 3, Warren S. Eaton, David Dunlap, W. Hogeson, Henry Melvin Frauenthal, and E. K. Jaquith, the aviator who recently flew from Atlantic City to Miami.

The committee, which was shown through the property by Messrs. J. P. Knapp, and his son, J. F. Knapp, found the station to be ideally located from a strategical standpoint, as it is half way between New York and Montauk Point, therefore making it possible for the seaplanes to undertake a patrol to almost any point along the coast of the Third Naval District.

The station having been found suitable for the purpose, it has been accepted by Admiral Usher, and the hangars for the seaplanes will be put up immediately, and one of the units of the Aerial Coast Patrol will take their training at the station.

Norma Bell with Norma Ball Bearing

Mr. Norma Bell, formerly sales engineer in the Automobile Division of the Lunkenheimer Company, Cincinnati, has joined the Norma Company of America—makers of "Norma" High-Precision Bearings—in a similar capacity.

Aero Club Presents Balloon

New York City.—Rear Admiral Usher of the Third Naval District last week accepted an offer from the Aero Club of America of an observation balloon, especially designed for anchorage from a ship from whence for many miles it could watch for submarines and other hostile vessels.

This will enable the Navy Department to begin the training of operators for observation balloons. At present the navy has only one aviation training station, which is at Pensacola, Fla., and this is being used exclusively for the training of fliers. The balloon is in course of completion by the Goodyear Tire and Rubber Company, at Akron, O. It is also making the observation balloon for the United States Army Reserves, the fund for which was raised by Mrs. Charles E van Rensselaer and others.

Another fund is now to be raised for the training of aviators for the National Aerial Coast Patrol of which Rear Admiral Peary, retired, is the head. The National Special Aid Society has appointed a committee to campaign for this fund. It is headed by Admiral Peary and Miss Ruth Law, and other members are Cosmo Hamilton, Mrs. Robert Oliphant, Mrs. Arthur Scribner, Miss Katherine Glidden, Mrs. William McAdoo, Mrs. Wilbur Matthews, Mrs. Henry A. Wise Wood, Mrs. George Stevenson, Mrs. Percy Stewart, Mrs. Frank Hagenmeyer and Mrs. C. L. Baldwin.

S. A. E. War Plans Ready

New York City.—The Society of Automotive Engineers has its plans well laid for co-operation with the national government on all matters of defense.

Some of the general activties of members of the S. A. E. in event of war will be: 1—To build engines for submarine chasers through affiliation with marine engineers; 2—To build aeronautical engines through affiliation with aeronautical engineers; 3—To build motor convoys and transports; 4—To man them if necessary. Thus the S. A. E. will serve the country on land, air and water.

War Talk by Ruth Law

New York City.—Miss Ruth Law told of her experiences on the western war front with the French Flying Corps at the opening of the tea garden, last week, at the show of the Society of Independent Artists in the Grand Central Palace.. From the opening and through the evening the garden was in joint charge of the Garden Club of America, represented by its President, Mrs. Charles Hoffman; Miss Katherine Dreier and others, and of the Aviation Committee of the National Special Aid Society, proceeds going to the Naval Aerial Coast Patrol.

There were talks also by Cosmo Hamilton, Henry A. Wise Wood and Rear Admiral Robert E. Peary, and moving pictures of the aero corps in action on the fighting front.

Estimated Output of Aeroplanes

Washington.—During the next year aeroplane manufacturers of the United States will be able to turn out for the army and navy 640 flying machines. The output at the end of two years is put at 2,000 machines, and at the end of three years at more than 6,000.

These figures are based on careful estimates made by army and civilian experts after a survey of the facilities and resources of the manufacturers.

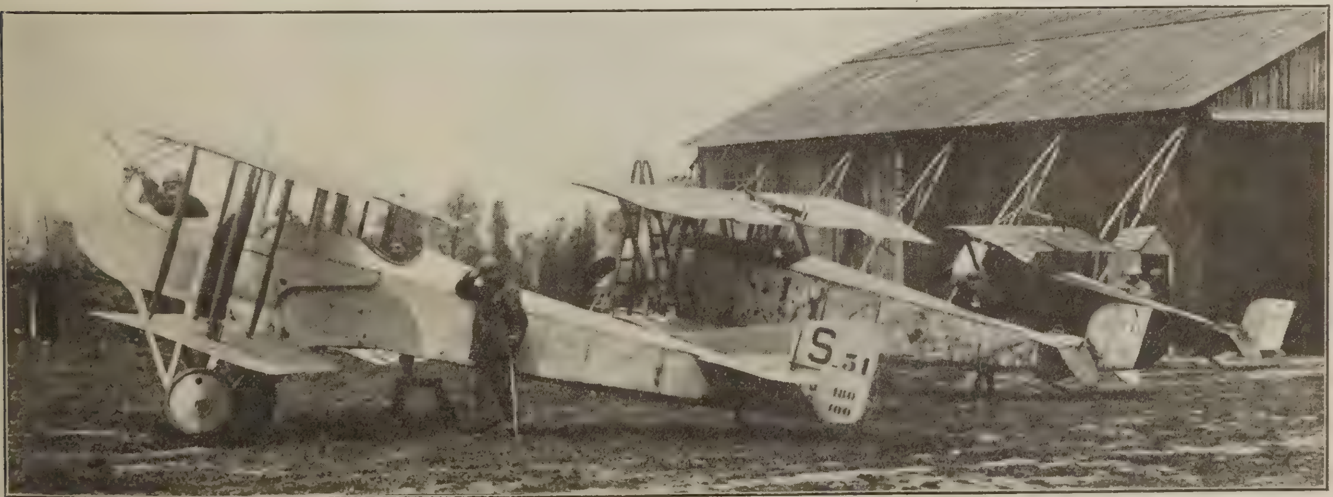
The army alone wants thousands of aeroplanes at once, but at present they are being turned out at the rate of about forty a month, with an increasing ratio.

Army Wants Thousands

The plans of the army alone for the next three years call for 3,700 machines by the end of the next fiscal year, 6,070 during the second year and 9,300 at the end of the third. These machines are of the school type for use in training flyers for the army. In addition, if it becomes necessary to send a force to Europe, the United States will require a large number of scouting machines, battleplanes and other types of aircraft used by the European belligerents.

The army now has less than 200 aeroplanes, whereas something like 10,000 young men and some young women have signified their desire to enter the aviation service. This branch of the army has been so exploited that officials are swamped with applications. Every private and army school is filled to capacity at present.

Would-be flyers are required to take a preliminary course of four months. This merely fits them to go ahead, but does not make seasoned flyers of them. The idea is to train there new squads of prospective flyers every year, giving each a course of four months.



The first picture of the French "Spad" tractor biplane (on the left of the illustration) that has been received in this country. Some of the unique details of this machine will be discussed in our next issue. The other machines in the picture are a Nieuport biplane and Nieuport monoplane scout

Pacific Aero Club News

San Francisco.—The eighth annual meeting of the Pacific Aero Club will be held in San Francisco on May 8, when the annual election of officers will occur and business of great importance will be transacted. Active participation on the national defense propaganda and the newly awakened interest throughout the country in aviation has resulted in the greatest activity in the Aero Club. The services of the club, which includes in its membership some of the ablest flyers and best technical men in the aviation industry, were offered to Secretary of War Baker and this offer was gratefully accepted by him on behalf of the United States Government.

The club is closely affiliated with the National Aerial Coast Patrol Commission at Washington, D. C., and with the Aero Club of America, of New York City, which is doing similar work on the Atlantic coast. Plans are now being formulated for the acquisition of a flying field down the peninsula where a clubhouse will be erected for the use of the members.

The newly aroused activities and the increasing number of applications for membership have resulted in a reorganization of the scale of membership with largely increased initiation fees for the various classes. All members in good standing prior to this action being taken are to be known as charter members and their dues will remain the same. This ruling also applies to those members who are engaged in the government service and to those who are active flyers or engaged in the aviation industry.

At the recent meeting in the Palace Hotel, President James C. Irvine, who has attended the Pan-American Aeronautical Exposition in the Grand Central Palace at New York City, as delegate from the Aero Club, made his report in which he described the great interest taken in the exhibits by all classes of people who thronged the building throughout the week of the exposition. Mr. Hall, of the Aerial Reserve Corps, addressed the club, giving a detailed account of the work being done. Vice-President Guy T. Slaughter responded to his remarks and announced that the reserve corps would receive all possible assistance from the club. The rapid movement of events is expected to develop a condition where the club will be in a position to take an important part in the coast defense movement which is now coming to a head.

Yale Flyers up at 4:30

West Palm Beach, Fla.—The thirty Yale students studying aviation for coast defence work after two weeks breaking in are being hardened for active service.

Lieutenant Trubee Davison, the ranking officer, son of H. P. Davison, gave instructions that the boys be called at 4:30 a. m. daily, and at 5:30 they are at the hangars hard at work. They have a training table with the same dieting given college athletes. They expect to stay here until June 15.

Boxer Volunteers for Aviation

New York City.—While nearly all the prominent boxers in America have announced their willingness to serve Uncle Sam, and doubtless will do so, Eddie Nugent, a welter boxer of Nutley, N. J., has the honor of being the first pugilist to enlist and begin actual service. Nugent left his home last week for Pensacola, Fla., where he will take up his duties as a member of th United States Aviation Corps.

Nugent is one of two out of eighty applicants at the Nutley recruiting station who passed the rigid examinations for admission to the country's air fighting service. He is 21.

Capitalization of Aeroplane Companies

Capital of new corporations for manufacture of aeroplanes and war munitions organized in March amounted to $2,825,000, compared with $2,450,000 in February. In 1915 amount was $3,835,000; in 1916, $50,192,000, and in the first three months of 1917, $6,825,000, a total of $140,852,000.

Export of Aeroplanes

The Editors of AERIAL AGE wish to announce that until further notice all reports of exports of aeroplanes and parts have been withheld by the customs authorities.

Organize Kentucky Aeroplane Corps

Louisville, Ky.—Organization of an aviation corps which later will offer its services to the Government was planned last week in this city. The preliminary boosting of the move is being done by Cliff Hogan and others interested in motor mechanics.

It is understood the company will elect a man of military experience as captain and give the noncommissioned offices to those most expert in handling aeroplanes and those experienced in building and repairing them.

Quentin Roosevelt in Aviation Corps

Montreal, Can.—Quentin Roosevelt, son of Theodore Roosevelt, has joined the Canadian Aviation Corps to obtain instruction for service with an American army at the European front should such an expedition go abroad, it was announced to-day. If no American troops go to France, Mr. Roosevelt will serve with the Canadian air forces.

Starting Aero Reserve in Boston

Boston, Mass.—An aeronautical naval reserve, with units comprising four officers with the rank of ensign and twenty-four men rated as machinists, mechanics, radio operators, etc., is being organized in the First Naval District. For this both officers and men are needed. Most of the officers will be actual military aviators, and will have an ensign's commission. Qualifications for an ensign's commission are a college education, or its equivalent, and, in particular, a good knowledge of plane geometry, trigonometry and algebra. Any applicants for a commission should brush up their knowledge of these studies before applying. Professor Klemin of the Massachusetts Institute of Technology has consented to give a class of candidates a course of instructon, consisting of sixteen lectures, running over a period of eight weeks, and coming at 5 P. M. Mondays and Thursdays, beginning Monday, April 9.

A written examination will then be given. It is the intention to instruct in flying the men who show the greatest proficiency in the subjects taught. Announcements of further instruction are to follow, but no one not familiar with plane geometry, trigonometry and algebra is likely to derive much benefit from these lectures.

Candidates for an ensign's commission are requested to call at the office of Godfrey L. Cabot, aviation aide, U. S. N. R. F., First Naval District, Room 940, Old South Building, between 11 A. M. and 4 P. M., any week day. Candidates for other positions should call on Lieutenant G. D. Murray on the seventeenth floor of the Custom House.

It is understood that no one will receive an ensign's commission until he has passed his final tests as an expert military aviator.

The city of Rio de Janeiro, taken from a training machine of the Brazilian Naval Air Service, by Lieut. Victor de Silva, Lieut. Roul Bandeira piloting the machine

Simplex and G. V. for Aero Engines

New York.—Among well known plants likely to be called upon for aviation engine manufacture are Simplex, now a part of the Wright-Martin Company and the General Vehicle Company. The former is now in full production with the Hispano-Suiza engine for the Allies while the latter is just completing a British order for Gnome engines and is now making them on a United States order. The capacity of the two plants is fairly large, and being already in production there would be no delay whatever in greatly increasing the outputs. The General Vehicle Company is also tooled up for the production of 3-in. shells and is practically through with its foreign order.

Magnetos Available for Aviation Service

One thing for which the American governmment will not be in difficulties in the same way as the Allies were is in the matter of magnetos. Splitdorf, Zenith, Bosch, and other firms are well able to take care of the aviation need, in fact their capacity is so great that the maximum demands that could be made by the air service would hardly be felt. Makers of such specialties as ignition devices, ball or roller bearings, carbureters, etc., are unlikely to be affected very much.

Nineteen Princeton Men for Aviation Corps

Princeton, N. J.—Of the 166 undergraduates at Princeton University who have left the college for military service ninety-three have gone into the mosquito fleet, nineteen into aviation, thirty-five to the militia, two to the United States Navy, one to Annapolis, four to coast patrol work, one to the Signal Corps and ten to France for ambulance service.

Standard Parts Adds Western Spring

Cleveland, O.—Definite announcement of the purchase of the Western Spring & Axle Co. by the Standard Parts Co. has been announced by President Christian Girl of that company.

Mr. Girl stated that the acquisition of Western completes the original program for the parts organization, and that the Standard Parts Co. will now be developed and rounded out on the basis of the companies now represented.

These include the Perfection Spring Co., the Standard Welding Co., the Bock Bearing Co., Toledo, and the Western Spring & Axle Co., with plants in Canton, Wheeling, Cincinnati and Carthage, Ohio, St. Louis, Connersville, Ind., and Flint and Pontiac, Mich.

The Standard Parts Co. as now constituted will use 175,000 tons of steel annually and will employ from 8,000 to 9,000 men. Its increased buyer power, with a large volume of production and diversity of products including springs, axles, rims, tubing, bearings, heaters, etc. together with an advantageous distribution of plants is expected to permit of many economies.

Marine Corps Reserve B.

New York City.—The U. S. Marine Corps has issued a call to automobile owners who wish to serve their country by enlisting in what it terms the Marine Corps Reserve B. Citizens who are capable of performing special useful service in the Marine Corps in the defense and maintenance of naval utilities, are eligible for membership in this class.

For instance, owners and operators of automobiles, motor trucks, motorcycles, aeroplanes, and other craft suitable for purposes in defense and maintenance of naval utilities, may be enrolled in this class and contracts made with such owners to take over their vehicles and crafts in time of war or national emergency upon payment of an indemnity.

Form Society to Train Aviators

New York City, April 12.—Six women decided yesterday at a meeting in the home of Mrs. Henry Slayback, No. 375 Park Avenue, to form the Aerial Aid Society, to train twelve college men as operators of seaplanes for the Aerial Coast Patrol.

Th society's founders are Mrs. K. R. Fell, Mrs. Henry A. Wise Wood, Mrs. Charles Carscallen, Mrs. Charles Baker, Mrs. Charles Smithers and Mrs. Slayback. The twelve men to be trained will form a unit of the Aerial Coast Patrol, to be assigned wherever the Navy Department may wish.

Henry Woodhouse, member of the Board of Governors of the Aero Club of America, said at the meeting Great Britain had spent approximately $350,000,000 on her air service. He said all ships approaching or clearing at British ports are inspected and convoyed by aeroplanes, and he urged similar protection in this country.

Fisher Offers Aeroplanes to U. S.

Indianapolis, Ind.—Mr. Carl G. Fisher, who recently made a formal offer to the Army Aviation Department at Washington, D. C., of the use of the Indianapolis Motor Speedway as a training camp for aviators, has, in a telegram to the Department, also offered aeroplanes to the Department in addition and called attention to the fact that hundreds of automobile testers in Indianapolis would make the best possible material for aviators in time of war. The Aviation Department is anxious to accept the offer, but has postponed acceptance pending action by Congress on a bill to provide funds for the establishing of aviation training camps.

National Institute of Efficiency Interested in Aeronautics

A meeting of the Board of Governors of the National Institute of Efficiency was held at the Aero Club of America, 297 Madison Avenue, New York, on Wednesday, April 4, 1917, there being present Mr. Melvil Dewey, Mr. Henry Woodhouse, Mr. Richard B. Watrous, and Mr. Karl V. S. Howland. Those present acted as proxies for Mr. Henry A. Wise Wood, Mr. J. Horace McFarland, Rear Admiral Robert E. Peary, Mr. Conrad H. Syme, Mr. Herbert W. Rice and Mr. C. J. Mar.

Appropriate reference was made to the death of Mr. William B. Howland, and the following motion was passed: "Recognizing the great work done by the late William B. Howland as a personal exemplar of efficiency and as the founder of this Institute, the Board of Governors takes this occasion to express its profound regret at his death, and directs that the memorial announcement already sent to the members be spread upon the minutes."

On motion of Mr. Woodhouse, seconded by Mr. Watrous, Mr. Melvil Dewey was unanimously elected to fill the vacancy in the presidency.

On motion of Mr. Watrous, seconded by Mr. Dewey, Mr. Karl V. S. Howland was elected to fill the vacancy of the Board of Governors.

On motion of Mr. Dewey, it was unanimously voted to amend the by-laws so as to provide for the election of seven trustees who between meetings of the Board shall have power to act for the Board in any matter not in conflict with the by-laws or the direct vote of the Board, and that the following members of the Board be elected Trustees: Mr. Karl V. S. Howland (Executive Chairman), Mr. Henry Woodhouse, Mr. Richard B. Watrous, Dr. Henry S. Drinker, Mr. Raymond B. Price, Mr. John A. Stewart, and Mr. E. St. Elmo Lewis.

On motion of Mr. Woodhouse, seconded by Mr. Dewey, Mr. John A. Stewart was elected Chairman of a Committee on International Affairs, with power to appoint members of the Committee.

On motion of Mr. Dewey, it was unanimously voted to amend the by-laws so as to provide for raising the number of Governors to thirty.

On motion of Mr. Howland, it was voted that in view of the desire of the Institute to be of the greatest possible service as an organization in the national crisis the preparation is authorized of one or more special monographs dealing with various aspects of the United States' participation in the war. This monograph is to include a chapter on efficiency in military aeronautics to be written by Mr. Woodhouse.

The action of the Secretary in sending to the Vice President—Hon. Alton B. Parker—a telegram of sympathy in respect of the death of Mrs. Parker, and also arranging for the attendance of three delegates—Rear Admiral Robert E. Peary, Mr. Henry A. Wise Wood and Mr. Henry Woodhouse—to the annual meeting of the American Academy of Political and Social Science, was approved.

May Have Aeroplane Factory in Atlantic City

Atlantic City, N. J.—It is reported here that Glenn Curtiss will shortly come to this city. With his coming there is information that the local plant, engaged in construction of aircraft, is be enlarged and taken over by the Government. It is now in operation, the executive departments being headed by trained men, and the building occupied has sufficient floor space in which the capacity of the plant, now four per month, can be speeded up to thirty per month.

Beryl Kendrick, who is interested in the aeroplane factory, has been drafted by the University of Pennsylvania, and will be placed at the head as instructor of the institution's plan to establish an aircraft school and a corps of men, which will be placed at the serivce of the military authorities. With him in the plant, as partner, is Blaine Elkins, son of the late United States Senator Elkins, of West Virginia, who, while he makes Washington his home, has been residing at the Traymore. He has been giving attention to the inventions being tried out at the factory here under the supervision of Glenn Curtiss, who built all the engines used here and supplied the designs from which they had been constructed.

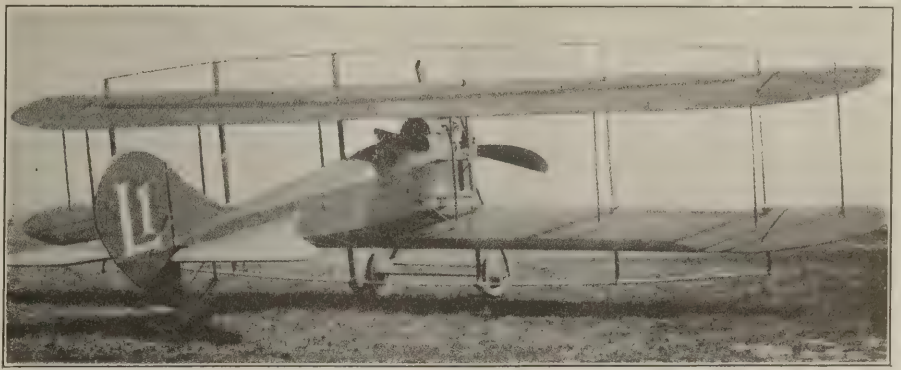
It is understood that the Government has had agents negotiating to lease the factory, and take it over in order to meet the rush order for hundreds of airships of the war types which the factory has been turning out.

Proffers Site for Aviation Field

Swedesboro, N. J.—Mayor Stone has made an appointment with representatives of the Aero Club of Pennsylvania to look at two or three sites in this vicinity, with a view of establishing a permanent aviation field. It is within a radius of 50 miles of Philadelphia. The borough council has taken up the matter, and there is every indication of success.

Champion Ready With Aviation Spark Plug

Flint, Mich.—The Champion Ignition Company, maker of AC spark plugs, now has ready for the market what it terms an aviation plug, but which is suitable for use on both aviation and racing motors.



The Model L-1 tractor biplane of the Lanzius Aircraft Co., with changeable angle of incidence, and equipped with a Duesenberg motor

Augustus Post Speaks Before Women's Club

New York City.—Mr. Augustus Post, of the Aero Club of America, last week addressed the members of the Brooklyn Women's Club, upon the subject of aeronautics.

Mr. Post urged Brooklyn women to send their sons into the aeronautic service. He said one aeroplane fighter was as valuable as a whole army corps, and that, although United States planes were inferior to foreign machines, they are being brought to a state of efficiency. He expressed satisfaction at the unfurling of the American colors by the Lafayette Aero Corps on the French front. He suggested that members of the Brooklyn Women's Club select proteges they desired to have trained in aero service and the Aero Club will train them.

Following Augustus Post's address on the aeronautic branch of the army and navy, in which training and preparation of this arm of the service were related, ex-Senator Towne declared that, in his opinion, the most important fact in connection with the talk was that almost every great instrument used in the war was of American invention. He mentioned the submarine, the aeroplane, ironclad battleships, armored trench tanks and the like. He pointed to these facts in illustrating his declaration that American genius will end the war.

May Locate Aircraft Factory in South

Richmond, Va.—With a view to locating a plant for the manufacture of military and commercial aircraft, C. M. Wanzer, of Ohio, is in the city relative to a site for the proposed factory. Business Manager Dabney, of the Richmond Chamber of Commerce, is giving Mr. Wanzer all the assistance possible.

It is said all the money necessary for the establishment of the plant has been subscribed, and a suitable site is now being looked for. Richmond, it is thought, will offer special advantages on account of climatic conditions and the location here of allied industries.

Army and Navy Orders

First Lieutenant Warren C. Woodward, Aviation Section, S. O. R. C., to active duty at Aviation Station, Memphis, Tenn. (April 7, War D.)

Each of the following officers is detailed in Aviation Section of Signal Corps and is rated as a junior military aviator on the date indicated after his name: First Lieutenants Clinton W. Howard, Field Artillery, April 6, 1917; Benjamin G. Weir, Infantry, April 7, 1917; Earl L. Naiden, Cavalry, April 8, 1917; Thomas J. Hanley, Jr., Infantry, April 9, 1917; Benjamin W. Mills, Infantry, April 10, 1917; George Pulsifer, Jr., Infantry, April 11, 1917; Harry B. Anderson, Cavalry, April 12, 1917; Walter W. Wynne, Cavalry, April 13, 1917; James F. Byrom, Infantry, April 14, 1917; Joseph T. McNarney, 21st Infantry, April 15, 1917.

Leave one month, about April 5, 1917, to Capt. Josiah C. Minus, retired, supply officer, Aviation Section, Signal Corps, San Antonio. (March 23, S. D.)

Signal Enlisted Reserve Corps

Sergt. Marcus H. Rice, Aviation Section, S. E. R. C., from duty at Mineola, Long Island, N. Y., to Curtiss Aviation School, Miami, Fla., for duty. (April 4, War D.)

First Lieut. William A. Reed, Infantry, D. O. L., to Fort Sam Houston for examination as to his physical fitness for service in the Aviation Section of the Signal Corps. (April 7, War D.)

Second Lieut. Lawrence C. Ricker, retired, to active duty and to Mineola, Long Island, N. Y., for duty. (April 7, War D.)

First Lieut. Arthur Boettcher, Infantry, D. O. L., from duty at Signal Corps Aviation School, San Diego, to Fort Omaha, Neb., Balloon School, for duty. (April 9, War D.)

To be first lieutenant, Sig. (Avia. Sec.), O. R. C., from March 1, 1917: Woodward, Warren O., 13, Oct. 21, 1889, Chicago, Ill.

Officers' Reserve Corps

Potter, Nathaniel H., 2, Nov. 16, 1878, Rochester, N. Y. To be first lieutenant, Sig. (Avia. Sec.), O. R. C., from March 1, 1917: Low, Seth, New York, N. Y.

To be first lieutenant, Sig. (Avia. Sec.), O. R. C., from March 6, 1917: Meyer, Cord, New York, N. Y.

To be first lieutenant, Sig. (Avia. Sec.), O. R. C., from March 19, 1917: Schauffler, William G., jr., Lakewood, N. J.

Board of Officers Created

A board to consist of Capt. Arthur R. Christie, junior military aviator, S. C.; Capt. Ralph Royce, junior military aviator, S. C., and First Lieut. Polk D. Brown, M. R. C., is appointed to meet at Signal Corps Aviation School, Memphis, Tenn., for the examination of persons for appointment as officers in the Aviation Section, Signal Officers' Reserve Corps. (April 7, War D.)

Group of students and instructors at the Curtiss Aviation School at Miami, Florida

CURTISS MODEL JN4-B TRACTOR

DUE to the fact that this machine has been widely used for training aviators both here and abroad, the JN type is probably the best known of all the Curtiss models.

It is comparatively light and for its useful load carrying capacity, is very compact. The JN has become so generally regarded as an unusually safe machine on account of its rigid construction and its ease of control, that it is extensively used in training, exhibitions, contests and other work of this character when flights are expected regardless of weather conditions.

The JN4-B is, as are all Curtiss aeroplanes, regardless of size or type, the composite issue of correct theory, fully tested materials, proper design, careful workmanship, accurate assembly and rigid, painstaking inspection.

General Dimensions

Wing span, upper plane	43′-7½″
Wing span, lower plane	33′-11¼″
Depth of wing chord	59½″
Gap between wings	62 3/16″
Stagger	12 5/16″
Length of machine overall	27′-3″
Height of machine overall	9′-10½″
Net weight, machine empty	1405 lbs.
Gross weight, machine and load	1890 lbs.
Speed range	75-43 m.p.h.
Climb in 10 minutes	3,000 ft.
Motor, Curtiss model OX	90 h.p.

Planes

Upper plane is in three sections; lower plane, one section each side of fuselage. Area of upper panels, excluding engine-section and ailerons, 161.2 sq. ft. Lower panels, 152.26 sq. ft. Engine-section panel, 10.95 sq. ft.

Weight of upper panels without sockets or wires, 124 lbs. Lower panels without sockets or wires, 108 lbs. Engine-section panel without sockets or wires, 12½ lbs.

Wing curve, Eiffel No. 36. Ribs lightened; wing contour of pine reinforced with birch strips. Wing beams of spruce, I section. Trailing edges of flattened steel tubing.

Incidence angle, 2°; dihedral angle, 1°; stagger 12 5/16″. There is no sweepback.

Ailerons are 11′-8 3/16″ long, 18⅜″ wide. Area, each 17.64 sq. ft. Weight, each, 13½ lbs. In cross section the ailerons conform to the contour of the main panels, from rear beam to trailing edge. They are hinged to the rear beam of the panel by four hinges each, with a gap of ⅝″ between the beam and the aileron.

Four masts are provided for bracing the overhang. Each mast weighs 1 lb.

Total weight of interpanel wires and turnbuckles, 21.25 lbs. Wing post sockets (for upper, 16.5; for lower 12) 28.5 lbs. Interpanel struts, 28.25 lbs.

Wing covering of Irish linen, coated with five applications of dope.

Fuselage

Maximum width of fuselage, 27″. Maximum depth, (fuselage framework) 34¾″. The tops of upper longerons are located 8 inches above the centre line of thrust. Longerons in forward part of fuselage are of ash, 1¼″ by 1½″ section. In the rear part they are of spruce, 1¼″ by 1¼″ section.

In the vicinity of the motor, the fuselage is covered with sheet aluminum. Doors are provided for access to the motor. The hoods, cowls and radiator are enamelled khaki. All metal fittings and parts (except tubing closed at ends), are copper plated and then enamelled black. The fittings throughout are drop forgings.

Unequipped, the fuselage weighs 154 lbs. The front seat weighs 6 lbs; rear seat, 7 lbs. Miscellaneous fittings, linen covering, throttles, bolts, etc., 36 lbs.

Instruments fitted on the instrument board are as follows: Stewart-Warner tachometer; athward level, 0° to 10°; Creagh-Osborne compass; U. S. oil gauge, 0 lbs. to 120 lbs: gasoline gauge fitted to tank; instrument board lights. Total weight of the board equipped with the above, 21½lbs. Switches weigh 5 lbs.

Provision is made for carrying tools weighing 17 lbs. and a fire extinguisher weighing 8 lbs.

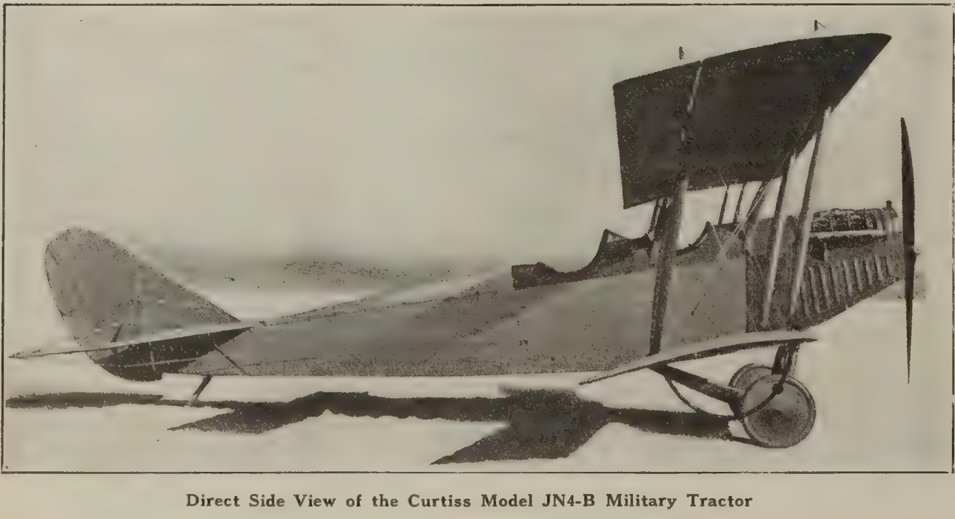
Controls

Dual control is provided in the following combinations: Curtiss-Deperdussin, Deperdussin-Curtiss, double Deperdussin.

The control bridge is of the inverted "U" type, double aluminum tubing. It is equipped with a 16″ aluminum spider, black walnut rim, hand control wheel. The cable guide sheaves are made of aluminum. Weight of the dual control (front, 15.8 lbs.; rear, 16.7 lbs.), 32.5 lbs. Control leads weigh 9 lbs.

The rudder operates 30° to either side of the longitudinal axis. Corresponding movement of the rudder bar is 45° each side of the centerline.

Total movement of the elevators is 60°, i.e., 30° above or below the neutral position. The corresponding movement of the control bridge is about 64°. The efficiency ratio is about 2.3; 1 at the center of the control.



Direct Side View of the Curtiss Model JN4-B Military Tractor

Landing Chassis

The landing gear is the two-wheel "V" type, with streamlined struts. Axles are guided in bronze saddle fittings. Wheels equipped with 26″ by 4″ tires. Span between wheel centers (tread), 63 11/16″. Weight of wheels, each 21 lbs. Struts, axle, wiring and fittings weigh 50 lbs.

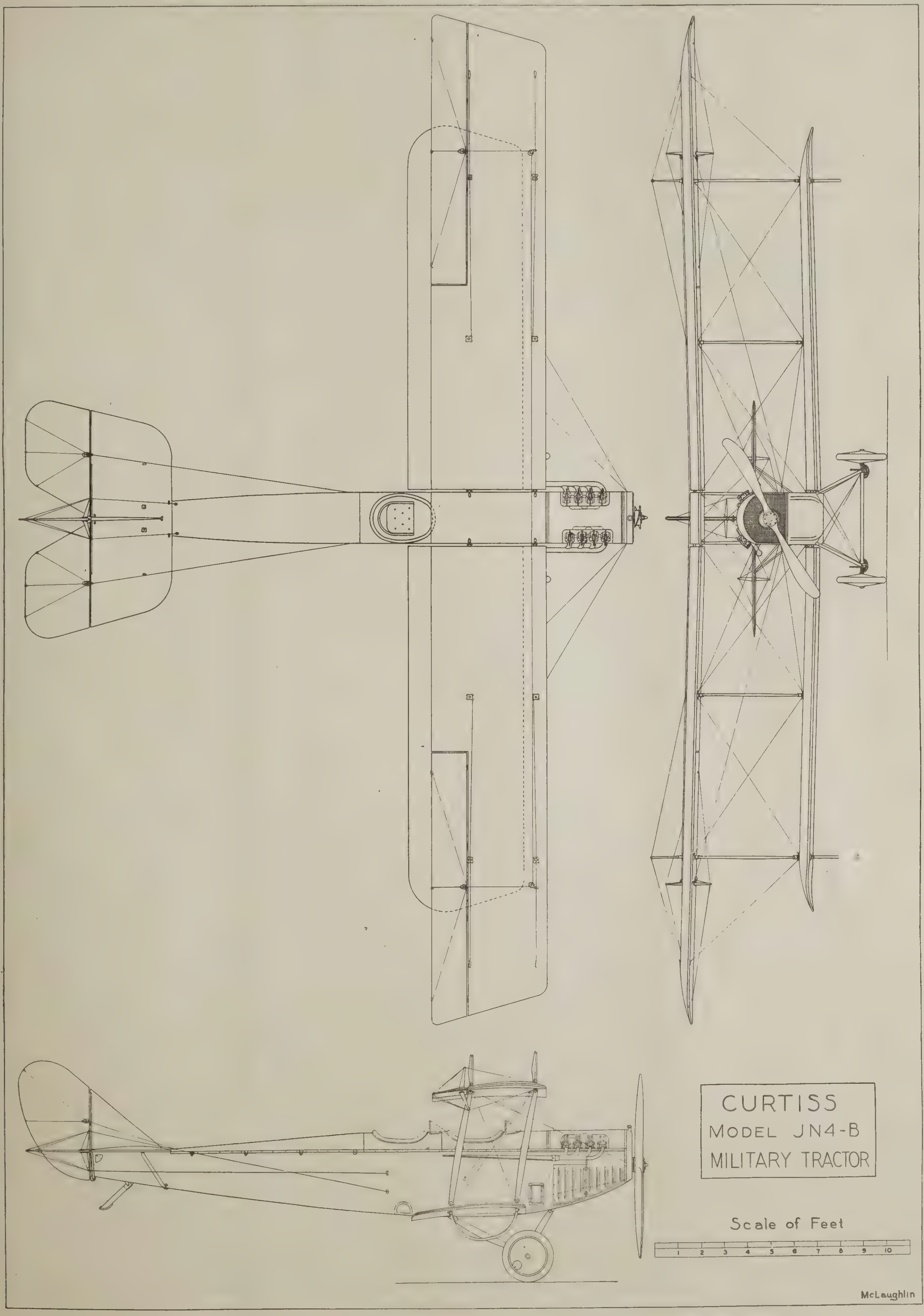
Below the outer interplane struts, rattan wing skids are fitted, weighing 2½ lbs. each.

The tail skid with braces weighs 8 lbs.

Tail Group

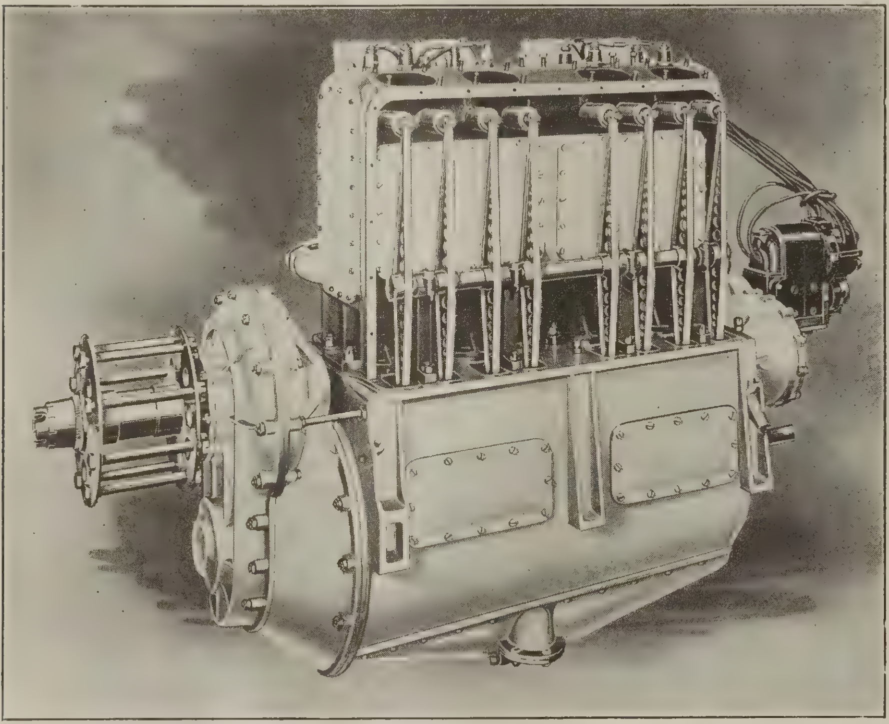
The stabilizing plane is non-lifting. The top is slightly cambered. Maximum length, 9′-3″; depth, 3′-6″. Surface area, 28.7

(*Continued on page* 201)


CURTISS
MODEL JN4-B
MILITARY TRACTOR
Scale of Feet
McLaughlin

DUESENBERG MOTORS CORPORATION ORGANIZED

One of the most interesting events of the more recent past is the formation of the Duesenberg Motors Corporation of New York City. The new corporation succeeds and takes over the business of the Loew Victor Engine Company of Chicago and the Duesenberg Motors Company of St. Paul. It will build on a commercial scale the efficient motors designed by Fred S. Duesenberg for marine, automobile and aeroplane service. A number of contracts already have been closed with some of the most prominent builders of high class motor boats, automobiles and aeroplanes, and production is already organized on quite a large scale. The official statement, which was communicated to AERIAL AGE, concerning the reorganization, is as follows:



The Duesenberg 16-valve, 4-cylinder Aero Motor

"The marine models of the Duesenberg Motors were brought out nearly two years ago by the Loew Victor Engine Company of Chicago, and have been in successful operation for some time, and the volume of business on these motors has been large for better than a year, and it is now one of the biggest factors in the marine engine industry. These marine engines are made in two sizes, a six cylinder—6¾ x 7¾ inch—and an eight cylinder—6¾ x 7¾ inch, developing from 200 to 400 horsepower. These two engines will be manufactured in the Chicago plant of the Duesenberg Motors Corporation, and this plant will do nothing else but produce these marine motors.

"The automobile and aeroplane engines manufactured by the corporation are now being built at the new plant located at Edgewater, N. J., this plant having been recently taken over, it previously being one of the big munition plants at Edgewater. Consequently its equipment was almost ideal for the manufacture of motors of the Duesenberg type, and it was only necessary to make a very few changes in the machinery and equipment of this plant to make it a highly efficient unit for the purpose desired. Manufacturing is now going on at the Edgewater plant, and production is rapidly climbing to the point where it will be possible to at least fill the immediate orders that the corporation has booked.

"The stockholdership of the Duesenberg Motors Corporation is in the hands of some of the best known men in business and financial circles of the United States. The officers of the new corporation are as follows: President, J. B. Harbeck; assistant to the president, E. P. Decker; secretary and treasurer, H. A. Wing; vice president, Charles Stollberg; general manager in charge of manufacturing, Charles B. Page; general sales manager, N. G. Rost; purchasing agent, G. H. Beilstein; chief engineer, F. S. Duesenberg; assistant engineer, A. S. Duesenberg; assistant engineer and naval architect, Morris M. Whitaker; assistant engineer, specializing in aeronautical division, F. G. Robinson.

"From this list it will be seen that the corporation already has established a highly efficient organization, made up of men thoroughly experienced in the various lines.

"The Board of Directors of the Duesenberg Motors Corporation is as follows: J. R. Harbeck, F. S. Wheeler, Charles Stollberg, Karl Breckenbridge, L. M. Welles, Frank B. Page.

"Mr. J. R. Harbeck has been president and managing director of the Loew-Victor Engine Company for the past three or four years, and it was under his active management that the Duesenberg Motors were developed for marine and aeroplane purposes. Mr. Harbeck will devote even more of his personal time and attention to the affairs of the Duesenberg Motors Corporation than he even did to those of the Loew-Victor Engine Company.

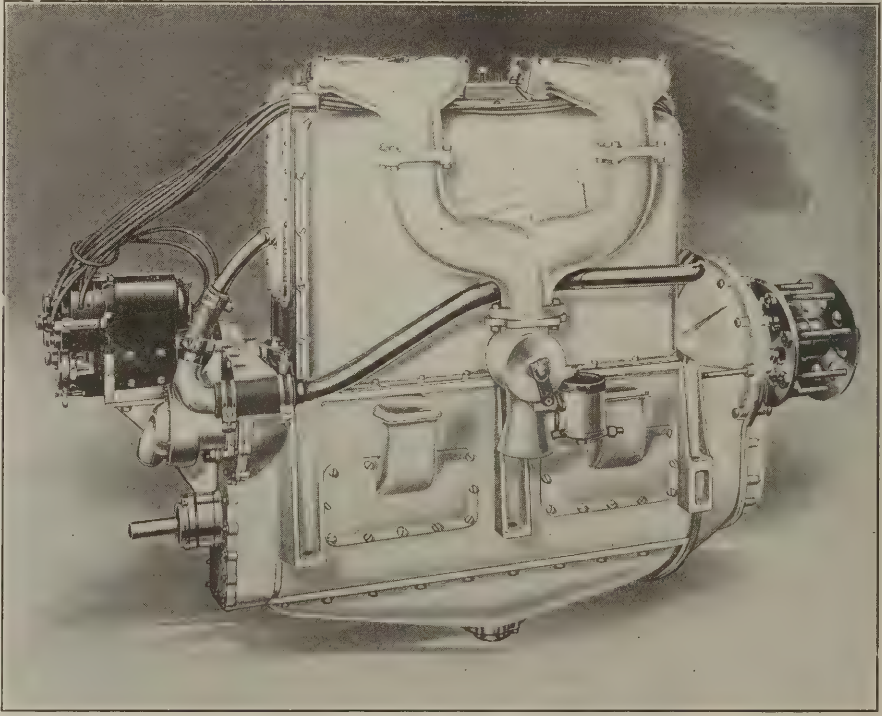
"Each of the three types of motors will be built on the same general design, differing only enough to adapt them to their individual requirements. The Duesenberg design has proven itself in actual service for a number of years. Better than sixty per cent of all racing cars on American speedways in 1916 were equipped with Duesenberg Motors. Duesenberg Motors were installed in the first motor boat to make a mile a minute speed. Duesenberg Motors were installed in the boat that won the displacement runabout classic at the Miami regatta this year. Duesenberg motors are installed in seaplanes now in the service of the United States Navy.

"The Duesenberg four and six cylinder automobile motors simplify the evolution of the Duesenberg design, which has passed through the severe test of automobile and motor boat racing, and now occupies a dominant position in the field of internal combustion engine design.

"The racing game has refined this design to a hitherto unattained degree. It has made it possible to build an engine developing more power in proportion to bore and stroke than any other motor in America. The weight, however, has been kept well within the necessary limit, and the motors are wonderfully compact.

"The Duesenberg design, as applied to automobile and aeroplane motors, has been worked out in full detail, and put on a commercial and manufacturing basis, and the plant at Edgewater, N. J. is now producing these engines and is now in a position to accept and efficiently handle large orders."

We hope to publish in our next issue a complete description of the new Duesenberg 4 cylinder motor.



The Duesenberg 16-valve, 4-cylinder Aero Motor

MUFFLERS FOR AERONAUTIC ENGINES

By PROF. H. DIEDRICHS and PROF. G. B. UPTON, of Cornell University[*]

I. THE PROBLEM.

The necessity for muffling the exhaust of aeroplane engines is hardly open to argument. The objects in view are the minimizing of noise to delay detection in military service, to protect the general public, particularly those living near aviation fields, and lastly to give the operator a better chance to know what the rest of his power plant is doing. The last point is perhaps even now of little importance, as an exhaust pipe long enough to end behind the operator is quite enough to make the exhaust noise less prominent than some other rackets.

A study of the general problem of silencing the areoplane power plant, not only in the laboratory but also by means of observing aeroplanes in a large number of flights, has led to certain conclusions, none of which are, however, new. In the first place the exhaust noise is not the only disturbance to be dealt with, although perhaps the most important, because the staccato barks of open exhaust carry to greater distances than the other attendant noises. It is, however, not a matter of great difficulty to so far suppress these barks that the exhaust noise ceases to be the most prominent in relation to some others. As a matter of fact, a simple pipe of sufficient length will do this for the high-speed multicylinder engines, and we understand that some American and German planes are using this scheme. It serves at least to protect the operator, even if it does not go a great way toward actually suppressing the pulsations as far as an observer at a distance is concerned. The very fact that the impulses follow so rapidly upon one another seems to make the problem of taking off the "bark" easier, for we found it much harder to muffle single-cylinder slow-speed engines.

Assuming, however, that a successful device for completely muffling the exhaust can be found, we should still have to deal with other noises, such as the hum of the propeller, the singing of gears, and the rattle of the valve gear. It will be admitted that all of these sources of noise can be minimized, but elimination does not seem to be in the realm of possibility.

On the 8-cylinder engine used for our last experiments the propeller of the fan brake caused a deep, more or less musical note, which appeared to come from the crank case. This noise disappeared when the blades were removed from the fan arm, and the engine was operated at speed under its own power, swinging only the arm. The same sort of humming note can be identified in connection with planes in flight at considerable altitudes and distances. To silence this disturbance presents a problem on which at present the writers have no suggestions, except that slower speed (geared) propellers might help.

Another source of noise is in the valve gear. In the case of the engine under test this consisted in a sort of rattling hiss at high speeds. It can be easily identified when the observer is close by. In planes of flight at some distance from the observers the noise would appear to be drowned in the exhaust roar and in the hum of the propeller. In any case this disturbance can be minimized by accurate adjustment. But it is difficult to see how the valve slap can be entirely eliminated.

The last source of noise is in the gears. This can be partly suppressed at least by the use of spiral gearing and by accurate machine work and mounting.

These four sources of noise are the principal ones requiring attention. We would place them in order of importance: (*a*) Exhaust noise, (*b*) propeller noise (*c*) valve-gear noise, (*d*) gear noise. We believe that it is most important to suppress the exhaust noise, because its staccato barks will undoubtedly advertise the rising of a plane sooner than the other three by reason of its greater carrying power. But the problem of the other noises remains; and we are further of the opinion, based on our experience in the past year, that the exhaust noise can be so far suppressed with comparatively simple means that it forms the smallest source of the disturbance of the four. We will not venture to predict complete suppression. Any muffler construction in connection with its manifold will have to take in some one of its parts the full force of the original blow, and since lightness of construction is one of the requirements calling for thin walls the chances are that there will always be more or less of a pulsating roar, at least near the engine. We have so far not reached the stage of considering this part of the problem.

Confining our attention now to the particular problem in hand, the silencing of the exhaust, a successful device will have to meet three requirements: (*a*) Satisfactory suppression of noise with least back pressure, (*b*) lightest possible weight, (*c*) greatest durability. For the last year we have confined our attention to the first of these, believing that the other two could be successfully met if the first requirement were satisfied.

II. PRESENT DEVELOPMENT OF MUFFLING DEVICES.

The state of perfection at present reached in the muffling of auto-engines is well known. As far as this problem is concerned, it may be considered solved as regards suppression of noise. Not a great deal of scientific data are available. Some tests were carried on at the University of Michigan, an abstract of the report being published in the *Horseless Age* for May, 1915. Five types of mufflers were tested and investigated as to back pressure, horsepower loss, and muffling ability. Of the five, the one given the highest rank on all three counts has the construction shown in figure 1. The engine used was a nominal 25 horsepower automobile engine (Hudson 6-54, 4⅛ by 5¼ inches), the test speed ranging from 750 to 1,300 revolutions per minute. At the latter speed the brake horsepower reached 40. The muffler weighed 14.5 pounds, which is equivalent to 0.36 pound per horsepower, based on the maximum power, and had a volume capacity of 847 cubic inches, which is approximately nine times the cylinder displacement. All of the other mufflers weighed more, so that 0.36 pound per horsepower may perhaps be considered the present minimum in automobile practice. This is a feature, however, of not as great importance as it would be in aeroplane practice. This muffler showed a back pressure of only slightly over 1 pound at the maximum speed, the loss of horsepower being only 1.4 per cent. at the maximum. For automobile practice this must be considered an excellent showing.

We were fortunate enough to obtain the loan of two mufflers especially designed for an 8-cylinder V-type engine and commercially manufactured. The smaller one of these mufflers is intended for a single cylinder and is 5 inches in diameter by 12 inches long. It has the construction shown in figure 2. The larger one, intended for four cylinders, is 5 inches in diameter and 28 inches long. The internal construction is probably made up of a multiplication of the elements of the smaller muffler. Both of these mufflers were tested by connecting them directly to the ends of the side manifolds by means of slip joints. Speed changes were noted by forcing the mufflers on and pulling them off by hand. This method of testing puts a heavier load on the smaller muffler than it is designed for, but since we did not have eight of them this was the only method available.

The tests on the smaller mufflers resulted as follows:

Throttle position on scale.	Back pressure, "Hg mufflers.		Corrected revolutions per minute, mufflers.		Back pressure increase, "Hg.	Speed drop.	
	Off.	On.	On.	Off.		Revolutions per minute.	Per cent.
4	0	0.25	933	933	0.25	0	0
5	0	.55	1,071	1,071	.55	0	0
8	0	1.90	1,257	1,143	1.90	7	0.52

Throttle position on scale.	Brake horsepower, mufflers.		Per cent. horsepower loss.	Brake mean effective pressure (pounds per square inch), mufflers.		Loss of brake mean effective pressure, pounds.
	Off.	On.		Off.	On.	
4	28.8	28.8	0	48.6	48.6	0
5	43.4	43.4	0	64.0	64.0	0
8	69.8	68.6	1.5	87.7	86.8	0.9

The larger muffler gave the following results:

Throttle position on scale.	Back pressure, "Hg mufflers.		Corrected revolutions per minute, mufflers.		Back pressure increase, "Hg.	Speed drop.	
	Off.	On.	On.	Off.		Revolutions per minute.	Per cent.
4	0.01	0.64	928	928	0.63	0	0
5	.025	1.5	1,066	1,060	1.48	6	0.51
8	0	4.0	1,268	1,240	4.0	28	2.24

Throttle position on scale.	Brake horsepower, mufflers.		Per cent. horsepower loss.	Brake mean effective pressure (pounds per square inch), mufflers.		Loss of brake mean effective pressure, pounds.
	Off.	On.		Off.	On.	
4	28.3	28.3	0	48.1	48.1	0
5	42.8	42.1	1.5	63.4	62.7	0.7
8	72.1	67.4	6.6	89.7	85.8	3.9

It will be noted from these figures that, in spite of the unexpected load, the smaller muffler gives the better results. As a matter of fact, the horsepower loss at rated output for the larger muffler is prohibitive. On the other hand, several observers judged that the larger muffler more effectively quieted the exhaust noise. The two, however, are so close together regarding this point that it became difficult to judge of the difference in connection with the other noises. Our conclusion is that both mufflers are good with respect to quieting and that the greater efficiency of quieting in the larger muffler is bought at too great an increase in the back pressure. We have no

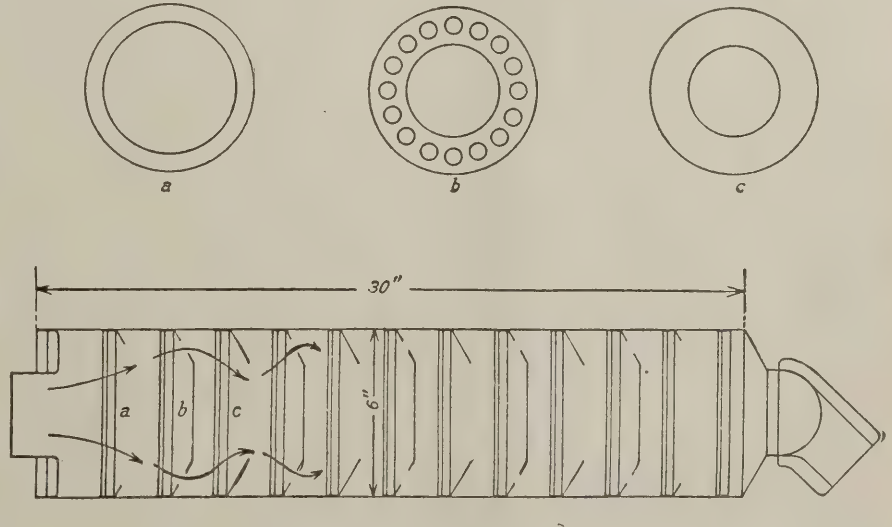


FIG. 1.

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[*] From the Second Annual Report of the Advisory Committee for Aeronautics.

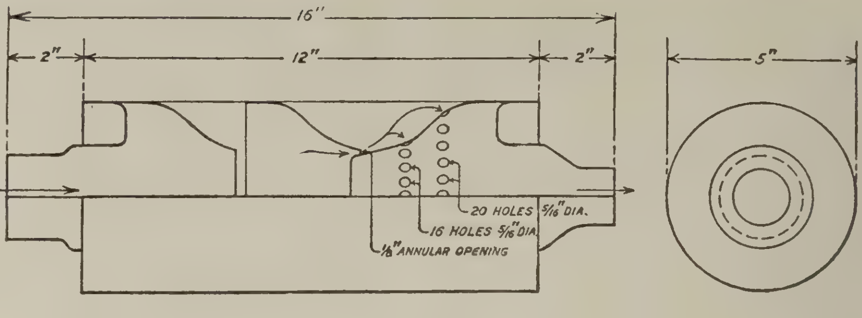


FIG. 2.

hesitation in saying that the smaller muffler is as good a solution of the problem as we have yet seen.

III. THE EXPERIMENTS.

Experiments with devices constructed by us were carried out partly on a single-cylinder slow-speed machine, partly on a 60-horsepower 4-cylinder Maxim engine, and lastly on an 8-cylinder Curtiss engine.

The principle underlying the action of muffling is simple. At the moment of opening of the exhaust valve the pressure conditions are such that the gases issue at velocities of approximately 2,000 feet per second. The problem is to reduce this velocity below that of sound (1,100 feet per second) without causing undue back pressure. The bark of the open exhaust is due to the issuing of the gases at velocities higher than that of sound, and the main disturbance is suppressed as soon as the velocities are brought below 1,100 feet per second. The means at hand to accomplish this are: (*a*) Cooling of the gases to reduce volume, (*b*) gradual expansion, (*c*) internal friction and eddy currents in the gas, and (*d*) frictional resistance between gases and containers and baffles. Of these the first mentioned is practically negligible, as the degree of cooling can not be great in the time available.

To bring into play the other three means would require a construction having the following essentials: (*a*) An entrance chamber several times the cylinder volume, to allow the unrestricted transfer of the gases from the cylinder to this chamber, for the purpose of preventing undue back pressure, and (*b*) one or more expansion chambers so provided with baffles as to break up the gas currents in such a manner as to cause decreasing velocity by means of both expansion and friction.

As far as application to the engine is concerned, three solutions are possible. The first is to use individual mufflers for each cylinder. This scheme at first sight has a good deal in its favor, but upon analysis several prohibitive disadvantages will appear. In the first place, there is no doubt that, say, 8 small mufflers will weigh more than 2, each taking care of 4 cylinders. In the case of the commercial muffler above mentioned, the weight relation is 15 pounds for 4 individual mufflers to 6 pounds for the single muffler doing about the same work. Further, the advantage that a 4-cylinder manifold will in itself act partly as a muffler is lost, and we would have the individual bark of each cylinder to deal with. And, finally, where the scheme had been tried it was found very difficult to properly stay so many mufflers as to prevent dangerous vibrations.

The second scheme is to combine manifold and muffler, i. e., to internally construct the manifold to convert it into a complete muffler. This scheme also looks good at first sight; but in order to provide sufficient volume a manifold so constructed would be of large diameter, since the lateral distance between cylinders is restricted, and it is a question whether it is desirable to place so large a heat-radiating surface next to the cylinders and the structural members of the plane. The question of adding weight at that height from the base to the side of the cylinders is also of importance with relation to possible excessive vibration. We tried one scheme of this kind on the Maxim engine, as below noted, but with doubtful success.

The third scheme is to use a regular manifold and to connect this by means of flexible hose to the muffler proper. This allows of any convenient placing of the muffler with reference to engine and to operator. The length of exhaust hose is of no importance, consistent only with low back pressure, and, given this, a considerable length of hose or pipe is a positive help to the muffler. We believe on all counts that this combination is the best solution.

The first experimental construction embodied the idea of making the entrance space a centrifugal whirl chamber in which the gases were to lose part of their kinetic energy by mutual interference before passing out through holes or slots in a central pipe. It was made up out of a 4-inch tee, the side branch of which was capped, and the cap then bored and threaded for the 1½-inch exhaust pipe, of a 6-horsepower oil engine. The opening from this pipe was placed eccentrically in the cap, so that the gases entered the 4-inch tee tangentially. One of the straight-run openings of the tee was plugged, while the other was bushed to receive a 1½-inch pipe. The pipe could be extended varying distances into the tee by a long thread. Tests were made with this central pipe not perforated in any way, but open at the end. The best results were found when this pipe extended to within ½ inch of the opposite plug. Later the end of the central pipe was plugged and the pipe perforated with holes, a second one was then tried perforated with slots. In these cases the gas, after whirling around in the chamber, found its way into the central pipe through the holes or slots and so on out. All of these devices were only moderately successful and did not seem to promise much.

It was then thought desirable to improve the entrance conditions to the whirl chamber by gradually broadening the entrance pipe, thus introducing the gas tangentially in a wide band. Figure 3 shows the construction. Three concentric central pipes, a 4-inch, a 3-inch, and a 2-inch were used. the latter being open to the air at both ends. The central pipes were slotted, the 4-inch and 3-inch pipes as in figure 3-a, the 2-inch pipe as in figure 3-b. It was found that the direction of the slots in the inner pipe caused the gas to move out of one end of the pipe, creating a distinct suction on the other end. This device showed up much better than the crude first construction. It was estimated to cut out 80 per cent. of the noise. Back-pressure readings were not taken, as we were as yet mainly interested in noise reduction.

The success of this device on the particularly vicious bark of the oil engine on which it was used led us next to construct a combined manifold and muffler of this type for the Maxim engine. The main features of this muffler were: An expanding, flattened nozzle from each cylinder to lead the gas tangentially into the shell, a common annular chamber between the largest inserted pipe and the shell into which the exhaust from all cylinders first entered, a series of four pipes 2, 3, 4, and 5 inch, with perforations so arranged that the gas must first pass through the wall of the 5-inch pipe in a slanting direction, and having attained a certain velocity in this direction must turn and pass through the 4-inch in the opposite direction because of the slotted openings. Another turn was necessary to pass through the 3-inch, and finally through the 2-inch to the atmosphere.

We did not succeed in getting a very good idea of the action of this manifold muffler, as the Maxim engine, which had been loaned us, was recalled. The trial run made promised fairly well, but the end joints between the pipe were not tight and considerable gas escaped. As built, with a cast-iron jacket, this muffler proved exceedingly heavy.

We have not done anything more with the manifold mufflers, but intend to try out one or two other ideas, which, however, have so far reached only the design stage.

The last work was done on an entirely different type from that above described. The underlying idea in this type is to provide an ample receiving chamber, and then as the gases work toward the outlet, to provide gradually increasing resistance, until the pulsations are toned down and the gas issues in streams of fairly constant velocity at speeds below that of sound. This should substitute for the bark a hiss like that of escaping steam of low pressure. It might be pointed out that the well-known Maxim muffler is of this general type. Only in this muffler the circular receiving chamber is followed by an annular space surrounding the former, which space is packed with baffle plates of spiral form. The gases here lose velocity by internal friction and surface friction. No attempt is made to utilize the idea of a gradually increasing resistance to the flow toward the outlet.

The scheme was tried out on the 8-cylinder Curtiss engine. Two manifolds of light-weight steel were cross connected by another manifold, so that we finally had a single discharge and only one experimental muffler had to be built. The construction of this is shown in figure 4.

We adopted for this muffler the prismatic form for two reasons. In the first place, it is easier to construct than the circular form; and secondly, we believe that this form may have some advantages over the circular form for stowing away on an aeroplane. The essential features are as follows: Gradually expanding entrance nozzle A, a receiving chamber B, two expanding and retarding chambers C and D. About half of the two expansion chambers are filled with closely packed wire gauze of decreasing mesh, in the following order going toward the outlets:

	Layers.
3½ inches of 2 meshes per inch	28
2½ inches of 3 meshes per inch	26
2 inches of 4 meshes per inch	24
1½ inches of 5 meshes per inch	18
1½ inches of 8 meshes per inch	20
1 inch of 12 meshes per inch	25

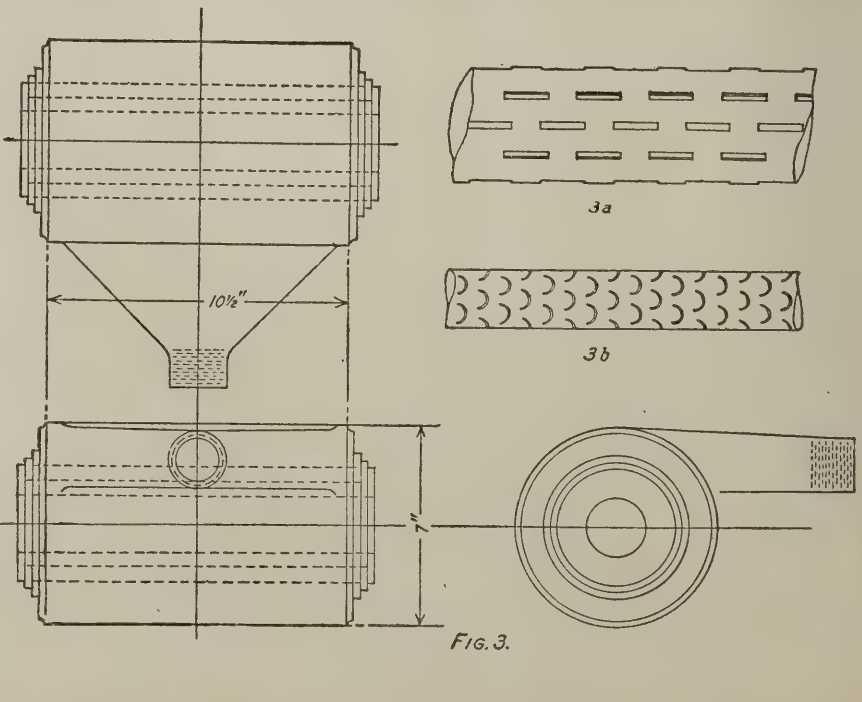
This muffler was connected to the outlet of the cross manifold by a short piece of flexible metallic hose and in parallel with a quick-closing gate valve. By this means the exhaust could be instantly changed from muffler to open air and back again. An electric tachometer, carefully calibrated, was used to note changes in speed, and the back pressures were observed by means of mercury manometers connected to the side manifolds near their connection to the cross manifold.

Trials with this muffler showed the following:

(*a*) The application of the side manifold and of the cross manifold alone served to tone down the barks considerably. The back pressure observed with only the side manifolds was negligible and with the cross manifold showed about 0.3-inch Hg. at rated output of 70 horsepower.

(*b*) The application of the muffler raised the back pressure only about 0.1-inch Hg., which is a very good result. The power loss is negligible.

(*c*) As far as muffling is concerned, three



3a

3b

FIG. 3.

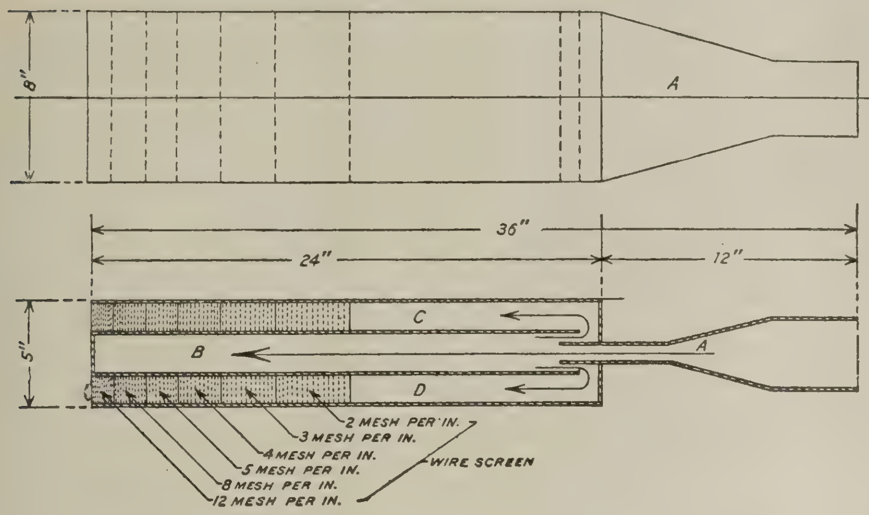


FIG. 4.

observers judged that the exhaust noise was cut out to the extent of about 50 per cent.

We believe that the muffling efficiency of this construction can be improved, and we have already started to work out an improved design. The virtual absence of back pressure is the most encouraging feature. Objection has been made to this design on the score of carbon clogging of the wire gauze. Only a service run of some hours' duration can prove this point.

At present we have not used any quantitative scheme of judging degree of noises, but have depended upon several independent observers. This scheme is not wholly successful on account mainly of the other noises present besides the exhaust. As a matter of fact, to get any idea at all of this matter in connection with the Curtiss engine, it became necessary to extend the pipe through a window and to place the muffler outside of the building. In the University of Michigan tests, above quoted, besides using independent observers, a telephone was used, the observer in a room some distance away noting the distance between himself and the telephone at which he failed to distinguish the exhaust noise. The receiver was placed near the engine. What such a scheme would show in our case is problematical, but we intend to try it out the coming year. We wish gratefully to acknowledge in this connection the active help of Profs. V. R. Gage and C. A. Peirce, of the Sibley College faculty, and the assistance and facilities supplied by the Thomas Aeromotor Company, of Ithaca, N. Y., and the Curtiss Aeroplane & Motor Corporation, of Buffalo, N. Y.

Further experiments will be made on this type of muffler construction and the determination of the laws affecting feed back pressure power loss are already being investigated and will be the subject of a future report.

(*Continued from page* 193)

lifted off their cams by the small lifting cam B, the lip of which engages with the small triangular projecting on the head of the tappets when the hand lever A is depressed. The details of this lifting mechanism are clearly shown in fig. 18. All the valves, both the inlet and exhaust, are thus opened in the cylinder head, and at the same time the lever A, by a connection of levers, closes the exhaust passage to the silencer by partially rotating the water-cooled barrel valve or exhaust throttle D in the exhaust manifold.

The exhaust ports and the outlet in the exhaust manifold are consequently in communication with a secondary outlet pipe that leads to a large suction hand pump E, by which gas is sucked into the cylinders from the two carbureters through all the inlet valves, as indicated in fig. 17, showing the engine with all the valves open. When the cylinders are charged, the valves are returned to their normal positions by the lever A, and the valve D automatically opens the exhaust outlet to the silencer in the normal running position and closes the pipe leading to the suction pump E. Ignition is then effected by means of a geared-up Bosch hand-starter magneto.

Normal ignition is by two Bosch magnetos—type 2H6—supported on a duplex bracket extension of the crank case in front of the engine, the magneto being driven by spur gearing off the crank-shaft bevel gear that also drives the water accelerator.

Two Bosch sparking plugs per cylinder are fitted, one on each side of the cylinder, the plugs being screwed into the combustion chamber directly below the valves, as can be seen by reference to sketches 17 and 18.

The following are a few figures in connection with the engine:

Stroke bore ratio, 1.266:1.

Stroke volume of 1 cylinder, 3357.58 cu. cm., 204.8 cu. in.

Total stroke volume of engine, 20145.48 cu. cm., 1228.8 cu. in.

Area of 1 piston, 176.715 sq. cm., 27.40 sq. in.

Total piston area of engine, 1060.29 sq. cm., 164.40 sq. in.

Clearance volume of 1 cylinder, 680.00 cu. cm., 41.48 cu. in.

Piston speed, 1495 ft. per minute.

Brake mean effective pressure, 107.4 lb. per sq. in.

Cu. in. of stroke vol. per b.h.p., 6.15 cu. in.

Sq. in. of piston area per b.h.p., 0.822 sq. in.

H. P. per cu. ft. of stroke vol., 282 b.h.p.

H. P. per sq. ft. of piston area, 175.4 b.h.p.

Area of inlet valve ports (each), 18.09 sq. cm., 2.80 sq. in.

Total inlet valve port area per cylinder, 36.18 sq. cm., 5.60 sq. in.

Max. lift of inlet valves (h), 9.3 mm., 0.366 in.

Area through each inlet valve ($\eta\ d\ h$), 14.024 sq. cm., 2.175 sq. in.

Total area through inlet valves per cylinder, 28.048 sq. cm., 4.350 sq. in.

Gas velocity through inlet valve ports, 122 ft. per sec.

Gas velocity through inlet valves, 157 ft. per sec.

Ratio of piston area/area through inlet valves, 6.3:1.

Area of exhaust valve ports (each), 9.621 sq. cm., 1.49 sq. in.

Total exhaust port area per cylinder, 28.86 sq. cm., 4.47 sq. in.

Max. lift of exhaust valves (h), 7.88 mm., 0.310 in.

Area through each exhaust valve ($\eta\ d\ h$), 8.66 sq. cm., 1.342 sq. in.

Total area through exhaust valves per cylinder, 25.98 sq. cm., 4.026 sq. in.

Gas velocity through exhaust valve ports, 153 ft. per sec.

Gas velocity through exhaust valves, 170 ft. per sec.

Dimensions of crank webs, 96×23 mm., 3.78×0.98 in.

Bearing, flywheel end, 90×66 mm., 3.54×2.60 in.

Protected area, 59.4 sq. cm., 9.2 sq. in.

Other bearings (6), 64×66 mm., 2.52×2.60 in.

Projected area (each) 42.24 sq. cm., 6.54 sq. in.

Total projected area of crankshaft bearings, 312.84 sq. cm., 48.45 sq. in.

Crank pin bearings (each), 72×66 mm., 2.83×2.60 in.

Projected area, 47.50 sq. cm., 7.36 sq. in.

Gudgeon pin bearing, 110×38 mm., 4.33×1.49 in.

Projected area, 41.80 sq. cm., 6.48 sq. in.

Length of connecting rod between centres, 312 mm., 12.282 in.

Ratio of connecting rod to crank throw $\frac{1}{r}$ 3.29:1

No. and diameter of big end bolts, four 14 mm., 0.551 in.

Diameter of camshaft, 21 mm., 0.826 in (diam. over splines).

No. of camshaft bearings, 5.

WEIGHTS OF VARIOUS PARTS.

Crankshaft, complete with camshaft drive pinion, bevel gear for driving water pump, and worm for driving cross-shaft for oil pump, 45.00 kilos, 99.208 lbs.

Steel flywheel, 30.40 kilos, 67.02 lb.

Piston, complete with gudgeon pin and rings, 4.92 kilos, 10.84 lb.

Gudgeon pin, 0.67 kilos, 1.476 lb.

Connecting rod complete, 4.895 kilos, 10.78 lb.

Weight of reciprocating part of connecting rod, 1.75 kilos, 3.86 lb.

Total weight of reciprocating parts per cylinder, 6.67 kilos, 14.70 lb.

The following test results of the material employed in the engine are of certain interest.

The crankshaft steel gives Brinell numbers as follows:

Front web, No. 285=65 tons steel.

Rear web, No. 321=72 tons steel.

Tensile and impact pieces prepared from the cylinder holding-down bolt give the following:

Yield point, 52.85 tons per sq. in.

Maximum stress, 58.65 tons per sq. in.

Elongation on 1.41 in., 19.15 per cent.

Reduction of area, 52.6 per cent.

Brinell hardness, No. 271.

Impact, 20.5 ft. lb.

A test from a portion of the aluminium crank case gives the following:

Maximum stress, 9.1 tons per sq. in.

Elongation on 2 in., 1.5 per cent.

Elongation on 4 in., 1.25 per cent.

Reduction of area, 3.24 per cent.

Bend through, 11 deg. broken.

The folowing results were obtained on analysis:

ALUMINUM.

Zinc, 12.34 per cent.

Copper, 1.06 per cent.

Iron, 0.86 per cent.

Silicon, 0.47 per cent.

Aluminium, 85.27 per cent.

Inlet valve spring contains no vanadium.

Exhaust valve: Vanadium present (percentage small).

THE 200 H. P. MAYBACH ENGINE

(Continued from page 113)

The method of obtaining a constant feed to the jet without the usual float chamber is as follows: Petrol is fed into the upper reservoir seen on the right-hand side at the top of fig. 7. From this reservoir it flows *via* the gauge filter-ended feed pipe downwards to the jet container, which, it will be noticed, is divided into two compartments by an inclined wall having a passage at its base leading into a short, wide "sealing" chamber or tube that is open at the top. At the top of the inclined wall is an air vent leading into the second compartment, and to the left in the top wall of the latter is another vent leading to the outer atmosphere. (It should be noted that this air vent does not in the actual construction come near the air intake port in the side of the throttle, and is only shown in that position owing to the exigencies of diagram making.) The hole forming the jet proper is drilled through the top face of a short cylindrical boss projecting up from the cover of the jet container. The exterior of this boss forms the bearing upon which the eccentric jet cap rotates. Downwards from the cover, and surrounding the jet boss, there depends a tube open at the lower end and reaching almost to the bottom of the "sealing" tube referred to above. Gasoline, then under the influence of gravity, flows from the upper reservoir into the first compartment and thence into the "sealing" tube, from which the jet draws as much as required; any surplus flow rises over the edge of the "sealing tube" and runs away into the overflow pipe at the base of the second chamber seen to the left in the diagram. As the upper reservoir tank and the "sealing" tube are both open to atmospheric pressure, the feed of petrol to the jet is unaffected by variation in altitude; that is to say, the gasoline level in the jet remains constant during any change in atmospheric pressure, as is not the case with the ordinary float feed. If more gasoline than required is fed into the upper reservoir it is carried away by the overflow pipe therein down into the second chamber, and thence, together with the surplus from the "sealing tube," away to the fuel supply regulator, or float chamber, shown in fig. 9.

In the fuel feeding system to the carbureters there are three units—a pressure pump, a valve box, and a float chamber or fuel regulator. The relative connection of these can be seen in the arrangement diagram (fig. 1).

Figs. 5 and 10 show the fuel pump system. An extension of the shaft driving the governor carries a small crank pin from which two connecting rods proceed to two pistons and pump cylinders set at right angles.

The horizontal or fuel pump has three connections, viz., a small bore pipe connected to an auxiliary hand pressure pump, and a pipe to dial gauges carried on the side of the crank case, while the other connection proceeds to the cylindrical fitting containing the valves for the pump. This fitting is bolted to the bottom of the crank case, as indicated at A in the general layout diagram (fig. 2), and is shown in detail in fig. 11.

The fitting illustrated in figs. 11, 12, and 13 is in appearance a cylindrical vessel, and is bolted at its top to the rear end of the bottom half of the engine crank case, as shown at A in fig. 2. It is divided into two portions, absolutely separate, the top one being devoted to the oil filtration, and the lower one to the petrol system.

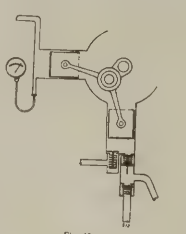


Fig. 10.

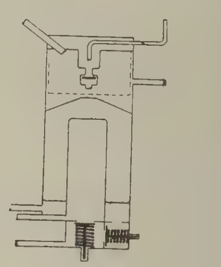
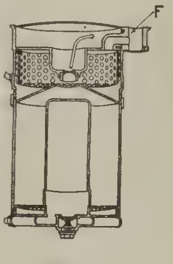
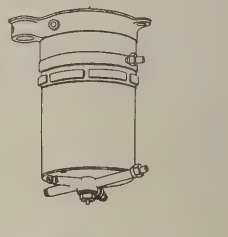


Fig. 11.





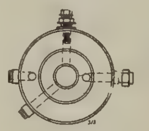


Fig. 12.

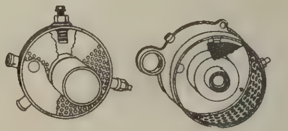
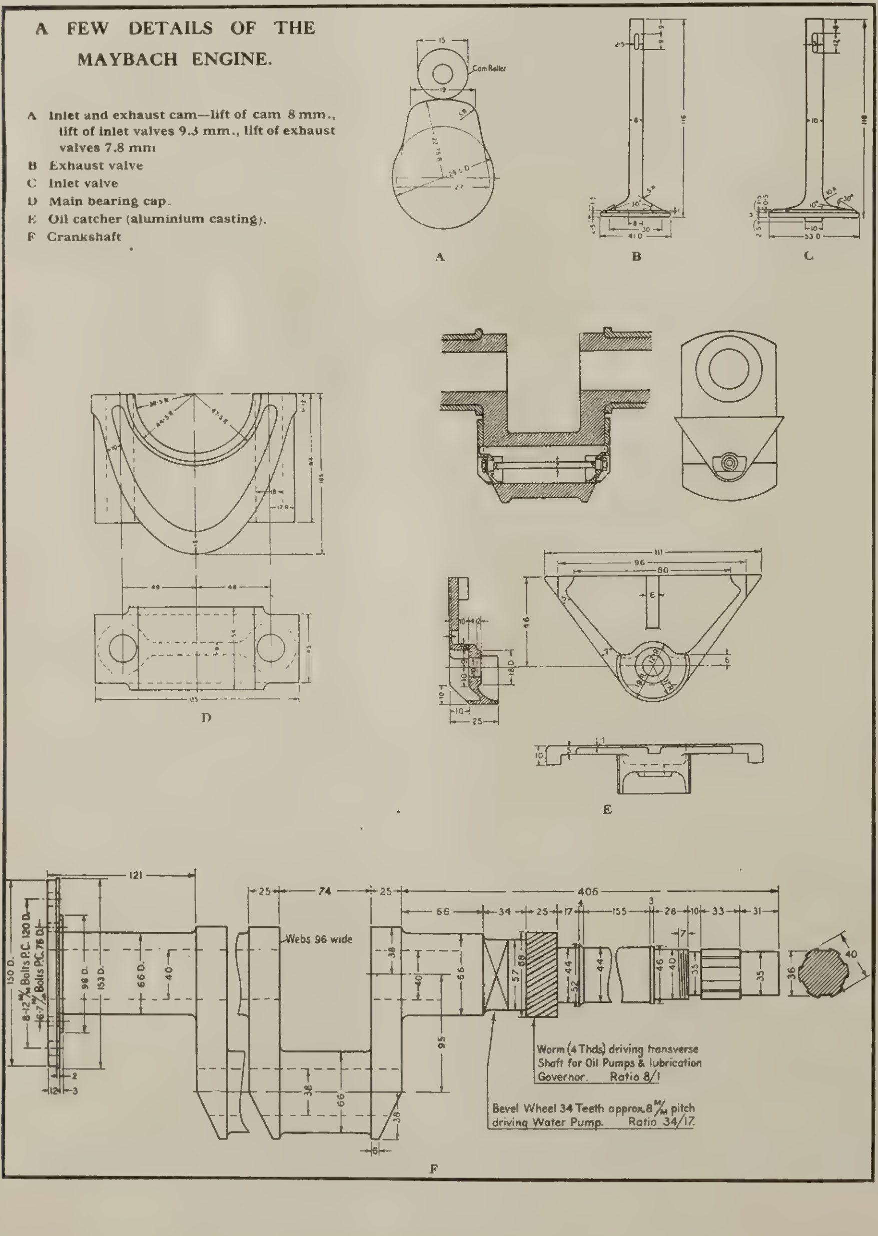


Fig. 13.



A FEW DETAILS OF THE MAYBACH ENGINE.

- A Inlet and exhaust cam—lift of cam 8 mm., lift of inlet valves 9.3 mm., lift of exhaust valves 7.8 mm
- B Exhaust valve
- C Inlet valve
- D Main bearing cap.
- E Oil catcher (aluminium casting).
- F Crankshaft

Worm (4 Thds) driving transverse Shaft for Oil Pumps & lubrication Governor. Ratio 8/1

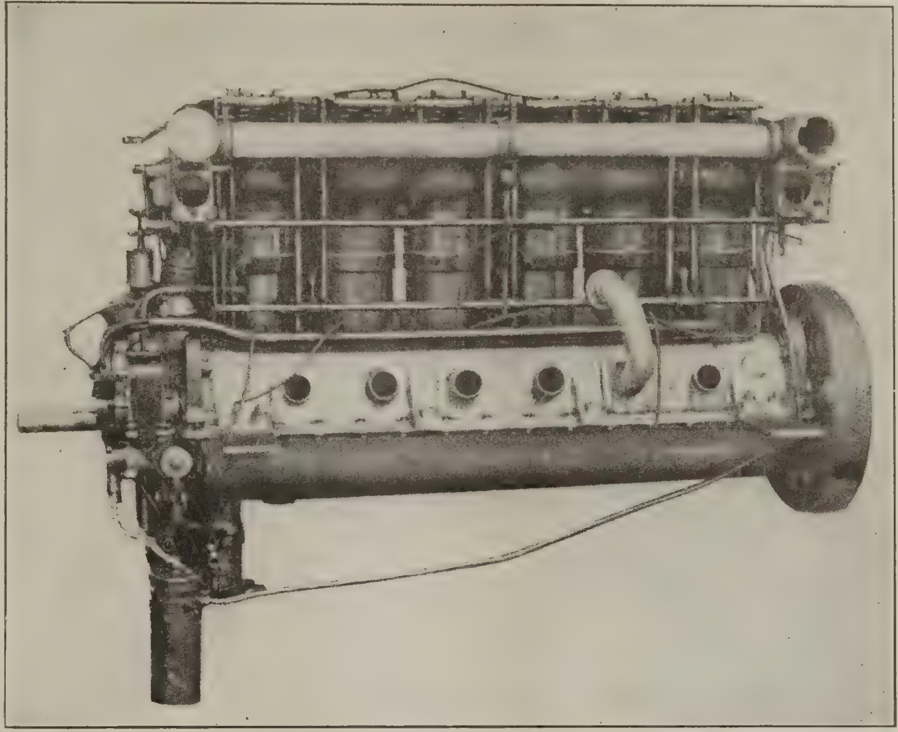
Bevel Wheel 34 Teeth approx. 8 M/M pitch driving Water Pump. Ratio 34/17.

The two portions presumably are located together merely for convenience—it may possibly be with the obeject of warming the petrol, and at the same time to assist in cooling the oil. Into the side of the top half a pipe leads from the oil pump, and the oil, passing through the gauze filter, issues from the pipe that leads to the main bearings (fig. 3).

The bottom portion of the device forms an air vessel and valve box for the pump used in the petrol supply system, and will be seen from fig. 1 to be connected with the horizontal piston pump shown in fig. 10. On its suction stroke the piston will cause the suction valve to open with a reduction of pressure in the chamber K (fig. 1). Whatever may have been drawn by the pump through K will be forced, on the compression stroke of the piston, through into the larger chamber, from which there is a pipe leading to the reservoirs above the jets of the two carbureters. The pump, therefore, effects delivery of petrol, and the two chambers in connection with the valves are intended to equalize the flow of petrol inwards and outwards in a manner similar to the dome or "air vessel" used on many types of pumps, and commonly seen on the fire engine. As the pump in this case is situated at a little higher level than the air vessel, it is evident that no petrol actually reaches the piston, and that the petrol is effectually pumped without connection with the pumping medium, the difficulty—or practical impossibility—of pumping liquid petrol being fairly well known.

In fig. 9 is presented a diagram, and in fig. 14 a perspective sketch of the mechanism that is in effect the float chamber. This device was carried beneath the base chamber, and well away from the carbureters. It consists of a cylindrical metal tank divided into two compartments, the lower being the larger. In the centre of the bottom of the upper tank ther is a tube depending well down into the lower one. This tube forms the only means of communication between the upper and lower chambers, and its lower portion makes a rough guide for a large float contained in the lower chamber. At its upper end there are two seatings for a double end needle valve. Normally this needle valve is held down on its lower seating by a coil spring. Provision is made that, as the lower tank is filled, the float rises, and a striker plate carried at its base, through the medium of a rod, lifts the needle valve up from its lower seat and causes the top point of it to close upon the seat. The striker rod that effects this is carried centrally on guides in the depending tube, and is divided in the middle, the valves being held apart by a coil spring presumably to give a cushioning as well as a "time" action to the mechanism, allowing the float a certain amount of travel before definite action takes place. The upper seating of the valve communicates with the upper tank, and is enclosed in a cylindrical gauze filter box. To the small chamber containing the needle valves, a pipe from the air vessel is connected, and, since suction from the pump takes effect upon the needle valve chamber, petrol will be caused to flow in from the pipe in the upper chamber of the fuel regulator. This petrol will flow through the lower portion of the chamber shown in fig. 11, and up to the fuel reservoir in the carbureter, any surplus from the carbureter returning down the overflow pipe into the lower half, or float chamber. As soon as this float chamber fills, the float rises, and eventually lifts the double end needle valve off its lower seating until it closes instead on to the upper seating. The suction is thus transferred from the upper chamber to the lower one until the petrol contained therein is used up and the float falls, allowing the needle valve to resume its normal position and the petrol supply its normal flow. There remain two more inlets to the float chamber, one of these being connected to the second carburetter, and the other to a pipe carried sufficiently high to prevent leakage but open at the end to provide an air vent to the float chamber. The fuel regulator device is made necessary by the system adopted for jet feed in the carbureter, a system probably aranged in view of the particular importance of avoiding fire dangers on an airship. The carbureter proper thus contains a minimum of petrol, the bulk supply in the float chamber being well removed from the danger zone of the engine by location beneath the base chamber. The arrangement employed also uses up any surplus petrol that overflows through the jet feed.

In figs 1, 15 and 16 are shown the essentials of a system intended to prevent the engine running if the pressure of oil in the lubricating system fails. Inside the crank case is a short cylinder open at the bottom end and containing a short piston, the rod of which passes through a guide in the cylinder cover and terminates in a collet between which and the cover there is a compressed coil spring. This spring endeavors always to draw the piston upwards into the cylinder on to a stop on the piston rod, the travel on the piston being limited to about three-eighths of an inch. Above the piston a port is provided in the cylinder wall; this leads to a port A, in a circular casing, the centre of which forms the cylinder barrel of a triple piston slide valve, shown in section in the lower diagram of fig. 15. In the one position of the piston valve, the port A is in direct communication through the circular distributor body with the second port G, and G is connected by a pipe to the outlet in the top half of the device shown in fig. 11; that is to say, in brief, that any pressure in the oiling system is communicated to the cylinder and tries to force the piston downwards. Bolted horizontally into the crank case beneath this cylinder is a case containing a spring-loaded plunger, the normal position of which is with the rod projecting into the sump as far as it will go. This plunger case is so placed in the crank case that the rod just clears the piston when the latter is in its highest position. At the outer end of the plunger is a striking arm that engages the end of a small laminated spring fastened to a rocker shaft conected by a series of bell crank levers and rods with the quick thread rising jet damping device shown beneath the jet hole in the diagram of the carbureter. With the plunger in its normal position—that is, projecting inwards to the crank case well under the piston in the manner shown—the dampers are lifted and the jet holes closed, or nearly so, according to the adjustment. An arangement is provided on one side of the engine bearers whereby the plunger rod can be drawn outwards by hand, so that the jets are opened.



The 200 h.p. Maybach Engine

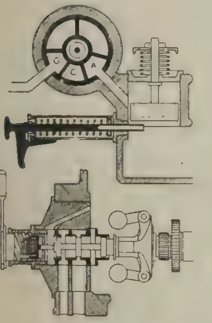


Fig. 15.

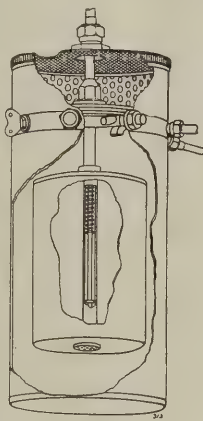


Fig. 14.

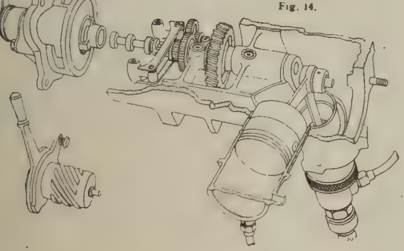


Fig. 16

The operation is probably as follows: Before the engine can be started up the plunger rod must be drawn by hand outwards in order to open the jet dampers. When the engine is started, so soon as pressure exists in the lubrication system, the piston will be forced downwards opposite the interior end of the plunger rod, so that if the grasp on the latter be released it will move inwards only a short distance, because the interior end of the plunger rod will strike against the side of the piston. So long, therefore, that pressure in the lubrication system is maintained, the dampers will be held off the jets, but if pressure fails, the piston will rise under the influence of its spring, and disengage the end of the plunger rod so that the latter will fly inwards, and in so doing cause the jet dampers to cut off the petrol supply in the mixing chambers.

With regard to the triple piston valve contained in the circular distributor body, a section of which is given at the bottom of fig. 15, this consists of a rod with three narrow pistons mounted on it enclosed in a tube, in the circumference of which two groves are cut, each groove being in communication with a port. The rod ends in a fork which engages with a small centrifugal governor driven by gearing from the crankshaft (see fig. 16). The governor rotates the rod and can slide it to and fro against the action of a spring-loaded plunger, shown in the left of fig. 15, which is carried in a case having a quick pitch thead on its circumference, and can be regulated by the lever as to its strength. The normal position of the piston valve rod is such that ports G and A communicate. As the speed of the governor increases, the tendency is to force the rod to the left, thus cutting off port A from port G, and putting port A in communication with the interior of the crank case through the port C, so that the pressure behind the piston is released and the jet dampers brought into action. The port to the left of the piston valves prevents a dashpot action. It is probable that, although the governor may be set to cut out the jets when the engine exceeds a predetermined speed, yet between the definite jet cut off, or minimum oil pressure, and the maximum oil pressure, there exists a certain range, and it is to regulate or control the oil pressure within this range that the hand setting to the oil governor is provided.

With regard to the self-starter scheme, by means of the lever A on the inlet side of the engine, as shown in the diagrammatic cross section of the engine (fig. 17), all the tappets are

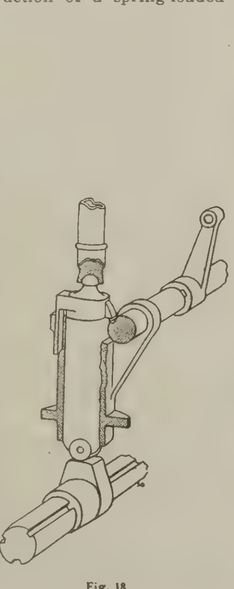


Fig. 18.

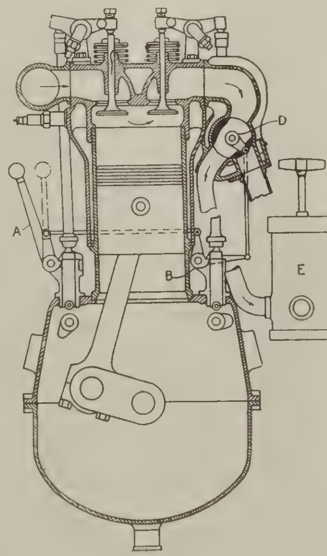
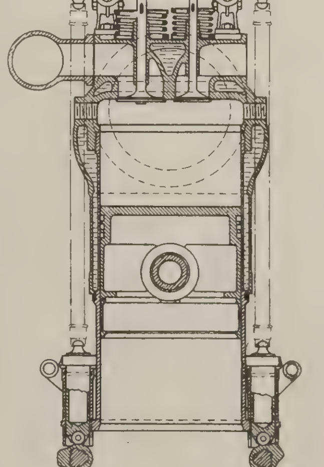


Fig. 17



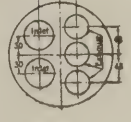


Fig. 19.

FOREIGN NEWS

FRANCE

Paris, April 13.—Lieut. Sweeney, an American with the French aviation corps, was promoted to captain to-day, and received indefinite leave of absence to "serve America," according to official announcement.

He will leave for the United States at the earliest possible moment.

Sub-Lieutenant Jean Navarre, famous French aviator, is being sought by the police on a warrant charging him with attempted homicide. Since he was severely wounded last June the aviator, according to the *Petit Parisien*, has acted in a most eccentric manner, but was punished lightly in view of the splendid services he had rendered to his country.

Recently he had a dispute with the police, in which he was worsted. That appeared to anger him, and a few nights ago he set out in an automobile and speeded through the principal streets of Paris, knocking down every policeman he saw. As a result five patrolmen were taken to hospitals and several others were severely bruised.

The aviator's friends, the *Petit Parisian* adds, believe that he is not fully responsible for his acts.

Sub-Lieutenant Navarre is one of the most noted of the French aviators. Officially he is reported to have brought down at least eleven German aircraft, and Paris newspapers attribute to him the destruction of nineteen German aeroplanes.

The Aerial League has sent its felicitations and fraternal wishes to the American aero clubs and its salutations to America in honor of American aviators who are in service in France or who have fallen in battle on French soil.

All the information and experience of French and British airmen is to be placed immediately at the disposal of the United States aviation corps by officers detailed by their government to proceed immediately to Washington and become attached to the office of the chief of the army aviation section.

The officers are expected to arrive within a week.

Paris.—The American aviators with the Lafayette escadrille in the French army are hoping that the United States will organize and train more flying squadrons and send them over to help the French. A member of the escadrille in a letter suggests that these squadrons might be named after members of the present squadron who have been killed in action, such as Victor Chapman, Kiffin Rockwell and McConnell.

This letter says that Raoul Lufbery and the French Lieutenant with the Americans each had a combat near St. Quentin a week or so ago, in which Lufbery had fired about forty shots as he dived on a German machine, when his gun broke and he was forced to leave the fight. The Lieutenant lost his opponent in a fog after firing sixty shots.

"On arriving at a new field yesterday," says another letter written on Easter Sunday, "every one was out to-day. Our French Lieutenant had four fights in quick succession. Harold Willis was with him in one of these, having his first battle. Willis attacked and continued firing until something went wrong with his gun.

"Kenneth Marr capsized on landing after his first trip over the lines and tumbled down a railroad embankment. He was not hurt."

Situated within six miles of the first-line trenches in the recently evacuated St. Quentin sector, with the big French guns booming almost under their noses and large calibre Krupp shells occasionally falling nearby, the American aviators are in a position to accomplish great achievements.

The only drawback is the aloofness of the German aviators, who have persistently refused to fly beyond their own lines, thus forcing the Americans to fight them above the anti-aircraft guns. Nevertheless, there have been two enemy machines shot down by their French Lieutenant, Delaage, and several Americans have had brushes with the enemy.

Their French commandant has addressed the American aviators, announcing that since the United States is now an ally the Stars and Stripes will float over the escadrille base and the aviators will be permitted to wear American army uniforms.

Several Americans, particularly those who have been serving for a long time, prefer to continue wearing the French uniform and wish to remain attached to a French escadrille.

"Of course, nobody would refuse to wear the American uniform," said Edward Parsons, explaining their feelings, "but some of us who have been here a long time had rather keep going as we are. Let the new recruits coming over form distinctively American escadrilles, officered by Americans, and wearing the American uniform, but I think the old-timers should be able to transfer to a French escadrille if they wish."

It is expected the American aviators will soon be ordered to purchase American uniforms, although it is understood the Lafayette Escadrille will continue to have a French officer in charge, with Lieut. Thaw. Red, white and blue ensigns will be painted on the Americans' machines.

Dudley Hill, who has been in the United States on furlough, is expected back at the front soon.

GERMANY

"On both banks of the river Somme," the German statement of April 14 says, "strong enemy forces again advanced against our St. Quentin position. The attacks failed under heavy losses, the British leaving three officers and more than two hundred men in our hands."

The statement says that the French exposed historical buildings in Rheims to the danger of damage by the effective fire of the Germans by placing batteries in the vicinity of the structures.

On the western front, it is added, the British and French lost 11 aeroplanes on Thursday and 24 aeroplanes and 4 balloons on Friday.

GREAT BRITAIN

London, April 13.—King George has become Colonel in Chief of the naval and military wings of the Royal Flying Corps "to mark his admiration of the splendid services both wings have rendered since the commencement of the war."

According to an official German statement Lieutenant William Leefe Robinson of the Royal Flying Corps, who was reported missing some days ago, was shot down on April 5, by a German battle aeroplane.

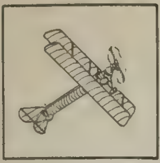
Lieut. Robinson brought down the first Zeppelin to fall on English soil, and was awarded the Victoria Cross.

A site, equipment, and operating funds for an aviation school to train Americans living in England, have been offered to the United States Government, by Barclay H. Warburton of Philadelphia, representing himself and Henry W. Rudd of New York, who is now in London. The grounds are part of Mr. Rudd's estate at Dingfield, just outside of London, and within half a mile of one of the Royal Flying Corps' quarters.

Mr. Warburton told War Department officials that the school would be maintained without cost to the United States until such time as the Government was ready to take it over. He said later that the department had approved of the plan in principle. The plan is designed to give the Americans in England an early chance for active service at the front by quickly developing efficient air squadrons. The Military Attaché of the American Embassy in London would handle applications for membership.

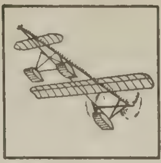
It is hoped that General Sir David Henderson, head of the Royal Training Corps of Great Britain, will detail officers who have seen active service as instructors for the Americans, though it is proposed to have the school itself, as well as such squadrons as are sent to the battle fronts, commanded by officers of the regular branch of the United States Signal Corps. Mr. Warburton probably will serve as a reserve officer.

Dismantling a German machine which was forced to land near the British lines on the Western front. Note the position of the exhaust pipes



MODEL NEWS

Edited by G. A. Cavanagh



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Paper Model Aeroplanes in the Making

By A. H. Curtis

So much has been written on the theory of paper aeroplane flying and of the "whys" and the "wherefores" that I think a few notes on the actual construction and flying of these interesting models would not be out of place. It is all very well to lay down a theory, but it is another thing to make the machine prove it in practice. The following is a short description showing exactly how to make a practical paper aeroplane that will not only give a faithful representation of a real machine but will also make good flights.

I find the easiest type to explain is the "Parasol" monoplane.

Firstly, as to the materials required: Some stiff paper (preferably Windsor and Newton's "Drawing Cartridge Paper," which can be had in 6*d*. blocks, 10 ins. by 7 ins., containing 20 sheets, which will serve to make as many models); a small piece of 3/16 in. square wood; some Gloy or paste.

Take a sheet of paper and fold it in half and trace out the outline of the monoplane as shown in Fig. 1.

Now cut this out, rounding all corners and bending where shown so that we have the machine as in the front elevation, Fig. 2.

Now it is necessary that the planes be kept together at the top. For this purpose cut out a rectangular piece of the same paper, 1½ ins. by 6 ins., and after rounding corners, paste this across the top of the planes.

The next thing to fit on is the rudder. Cut out the outline therefore as seen in Fig. 3.

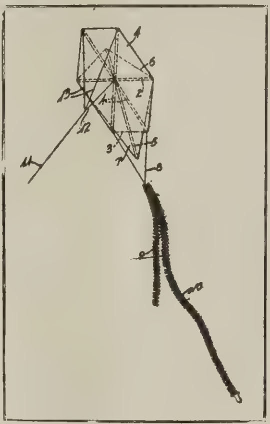
Now paste the shaded portion on both sides and place rudder in position, at the rear of the body, between the two layers of paper.

If the machine was flown in this condition (provided it was weighted), the planes would buckle up. To prevent this take another piece of paper and fold it as before, and cut out shape indicated in Fig. 4, folding where shown and sticking on to the body and wings as in Fig. 5.

This should be fixed on so as to give a very small dihedral angle, *i.e.*, the planes must be practically flat.

(*To be continued*)

Kite Patent



Armando Roa

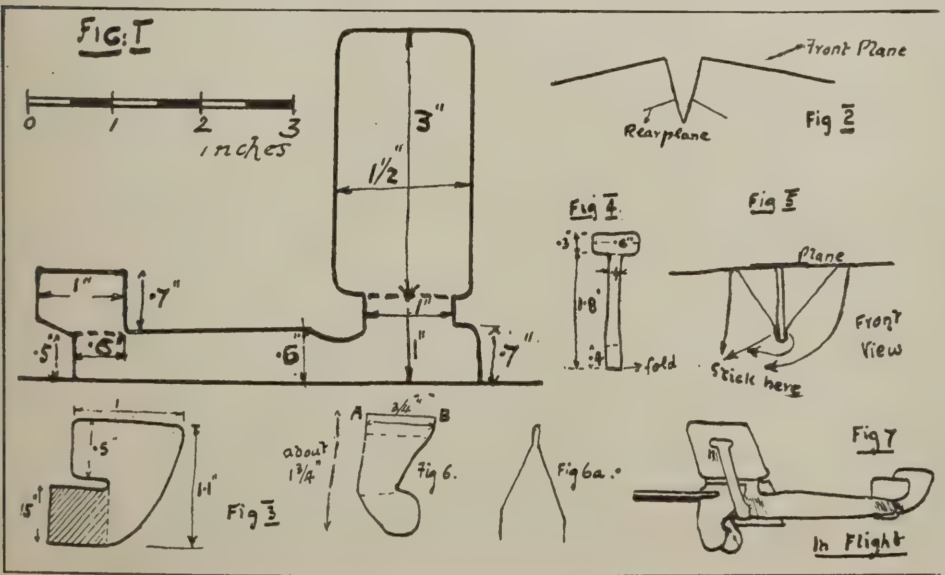
1,214,592. KITE. Armando Roa, New York, N. Y. Filed Aug. 14, 1916. Serial No. 114,712. (Cl. 244—22.)

1. A kite comprising a framework, a covering disposed over the framework, stiffening means carried by the framework and extending below the main body of the kite to form a plane, a double tail secured to the body of the framework, and means for attaching a cord to the framework.

2. A kite comprising a framework, a covering disposed over the framework, stiffening means carried by the framework and extending below the main body of the kite to form a plane, a double tail of unequal lengths secured to the body of the framework, and means for attaching a cord to the framework.

3. A kite comprising a frame having a cover thereon, having its opposite sides of equal length, an attaching member of a length nearly approximating the distance from the center to the upper end of the kite, two attaching members having their ends secured to the upper corners of the frame, a tail suspended from the lower end of the first mentioned attaching member, and a cord secured to the free ends of the last mentioned attaching members.

4. A kite comprising a framework of four intersecting members, one of which projects below the others; a cord disposed around three of the intersecting members, a second cord disposed around the ends of projecting member and one of the other intersecting members, a cover disposed over the framework and the cords, a tail secured to the bottom of the framework, and means for attaching a securing cord to the framework.



The above article is the beginning of a series of articles on the making of paper models

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Right from the Battle-Front.

Pilot, recently returned from Europe—"Yessir, I was so high on one of my flights that when I looked down and saw an uncle of mine far below me, he was so small that he looked like and aunt."

(Hint by the author. Aunt-Ant.)

The High Cost of Living.

Our expert advice in these days of soaring food prices is to biplane food.

A Visit to Mineola in 1909.

Way back in 1909, long before we ever knew that we would some day be thrust into this game of aeronautics, we paid a visit to the aviation field—hopping ground, it should have been called then.

Traveling by motah; no, not *motor—motah,* we arrived at the field one Sunday afternoon about three. Hundreds of automobiles were lined up all around the field waiting for the aspiring, and perspiring, pilots to get their engines tuned up for the flight. Being very young at the time, we could hardly wait for the flying to commence.

Pretty soon, a man dressed like a cross between a Swiss Mountain Climber and a Japanese chauffeur issued mysteriously forth from the sheds, and proceeded to walk slowly upon the field. The babble around the field ceased. We all knew that something was about to happen. What *was* going to happen we did not know, but *something* was going to happen. Trouble was, nothing *did* happen. The man walked around the field a few times and then proceeded to go back into the shed. But at last an aeroplane was pushed upon the field by a gang of about a hundred workmen, all dressed like the first one. Once upon the field they all ran all over in circles, each one with the idea that his mission was of vital importance to the flight which was about to take place. After they had run themselves completely out of breath another queerly dressed man emerged from the shed.

"Ah, there's the aviator," said the man who took all us children down to see the affair.

"How do you know?" we asked him.

"Saw him in the hospital last week."

The aviator proceeded slowly across the field, to the cheering of the multitude. Arriving in the center he paused for a moment, tested the wind, and after shaking hands with a few of his best friends, climbed into the aeroplane.

Two hours later the motor was finally started, and he whizzed across the field. When he had finally attained the terrifying speed of about twenty-five miles an hour, he was seen to jerk frantically at some lever, and the machine gave a short hop, settled down again, something broke, and the whole contraption was wheeled into the shed again.

"Wonderful flight!" said the man next to us.

"Marvelous!" said his campanion.

And we drove home with another illusion sadly shattered.

On With the Dance.

Cholly. Do you know the latest dance?
Percy. No, what is it?
Cholly. The "Panama Canal."
Percy. What's that?
Cholly. Just a series of slides.
Percy. Oh! I always thought it was the "Lock-step."

A. P.

(And the latest dance clothes are probably made with the Culebra cut.)

Undoubtedly Brooklynites.

Newspaper item. "At the start of the fifth inning of the first game in the National League, played between Brooklyn and Philadelphia, Brooklyn was far behind in the score, when two aviators were seen flying over the field. They came down quite near, and evidently seeing the score on the score board, they flew away in disgust."

Songs of the Royal Flying Corps

Ode to the R. A. F. Engine

Eight little cylinders, sitting facing heaven,
One blew its head off—then there were seven.
Seven little cylinders, used to playing tricks,
One warped its inlet valve—then there were six.
Six little cylinders, working all alive,
One got a sooted plug—then there were five.
Five little cylinders, working all the more,
One overworked itself—then there were four.
Four little cylinders, flying o'er the sea,
One shed a piston ring,—then there were three.
Three little cylinders, wondering what to do,
One over-oiled itself—then there were two.
Two little cylinders, very nearly done,
One broke a valve-stem—then there was one.
One little cylinder, trying to pull round seven,
At length gave its efforts up and ascended into heaven.

SO YOU WANTA RESIGN FROM TH' CAVALRY AN' JOIN THE AVIATION SQUAD EH?
YEP, I'M GONNA WRITE TO GENERAL FUNSTON AN' ASK HIM TO TRANSFER ME!
TAKE MY ADVICE AN' STICK TO TH' CAVALRY ETHELBERT OL' TOP!
NAW, I WANT TER BE AN AVIATOR, AN' GET MY NAME IN TH' PAPERS AN' BE TALKED ABOUT!
GOSH! Y'DON'T HAVE TO BE AN AVIATOR TO DO THAT!!
AN' BESIDES THERE'S A BIGGER CHANCE TO RISE —
BUT OH KID, IF YOU FALL, IF YOU FALL, WHAT THEN?
POP

—*Courtesy N. Y. Globe*

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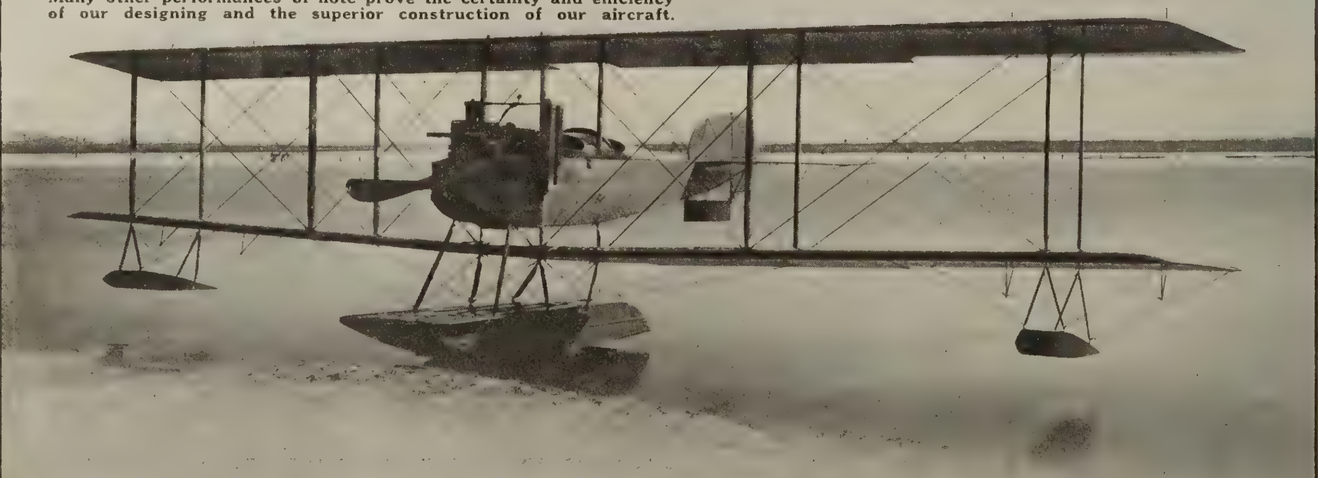
THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.



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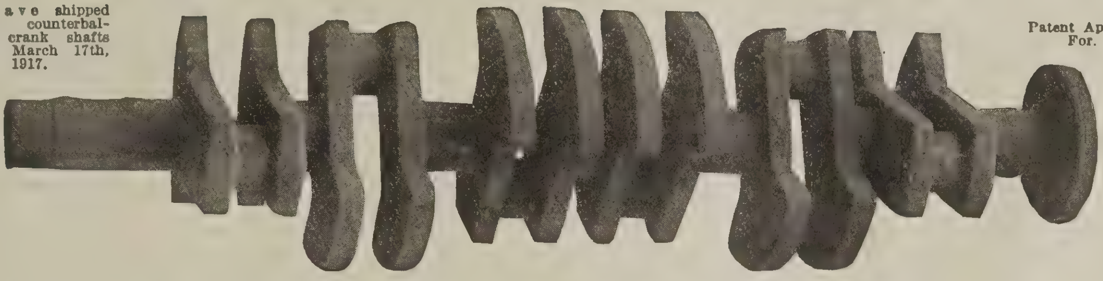

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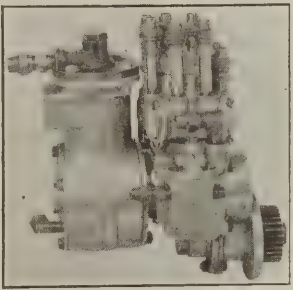

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Curtiss Model JN4-B Military Tractor

(*Continued from page* 187)

sq. ft. Weight 15½ lbs. It is suported from beneath by a pair of steel tube braces each weighing 2¼ lbs.

From tip to tip the elevators measure 10′-3″. Each 33 13/16″ wide, giving an area of 11 sq. ft each. Weight, each, 8½ lbs. Each elevator flap is attached to the plane by three drop forged hinges.

Vertical stabilizer triangular in shape, has an area of 3.8 sq. ft. Weight, 2½ lbs. The rear edge of this fin is formed by the rearmost vertical fuselage member. Light guys are run from the top of the fin to the rear edge of the stabilizer, continuing underneath the plane to the bottom of fuselage.

The rudder is 37⅜″ in maximum depth. Overall height, 62¾″. Area, 12 sq. ft. Weight, with control braces, 9.75 lbs. The rudder post is of steel tubing. Trailing edge of flattened steel tubing, brazed and attached to the post. Webbing of the rudder is spruce, secured to the framework by means of metal straps brazed to the tubing. Three hinges carry the rudder.

Motor Group

. Motor, Model OX 8-cylinder, Vee, four-stroke cycle, water cooled. Rated horsepower, 90 at 1,400 r.p.m. Bore, 4″; stroke, 5″. Weight per rated h.p., 4.33 lbs

Fuel consumption per hour, 9 gallons Fuel consumption per b.h.p. per hour, .60 lbs.; oil, .03 lbs.

Engine beds are laminated, ash-spruce-ash. They are supported by radiator bracket on front end and by cross-beam at rear end.

The motor complete weighs 390 lbs. Muffler, 20 lbs. 20 gallons of gasoline weighing 124 lbs. are carried in a tank weighing 20 lbs. Tank fittings and piping, 10 lbs. Radiator, 53 lbs. Radiator piping, 7 lbs. Water, 36½ lbs. Propeller, diameter and pitch according to requirement of performance, 25 lbs. Centerline of propeller, 59½″ above ground.

Summary

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The loading per rated horsepower of the motor is

$$\frac{\text{Gross total load}}{\text{Rated h.p.}} = \frac{1890}{90} = 21 \text{ lbs.}$$

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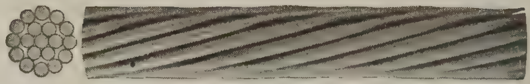

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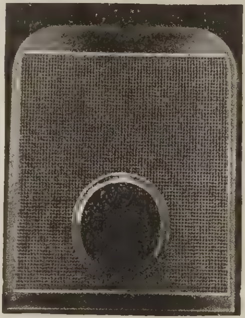

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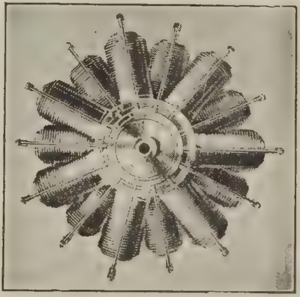

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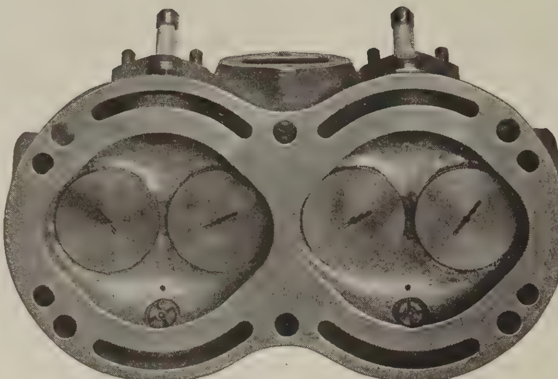

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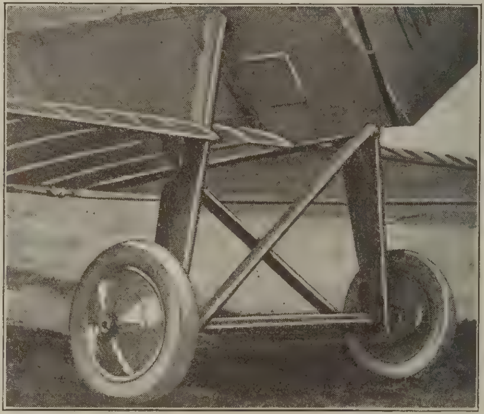

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Simple—Rugged—Thoroughly Efficient

Broad distribution
of shock permits
light weight

Sturtevant Aeroplane Co.
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A Labor and Time Saving Invention

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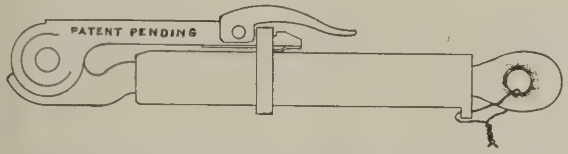

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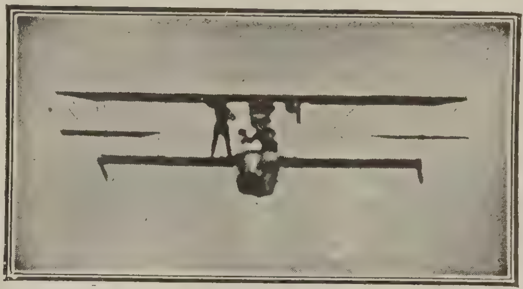

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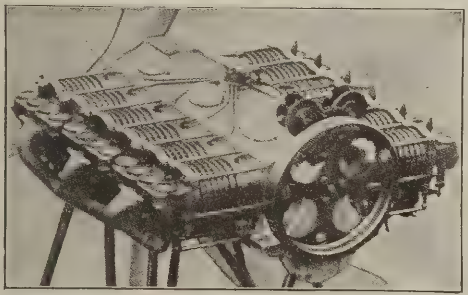

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They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

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Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
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Oil Consumption—105 H.P.—1¼ Gals. per hour, Good Grade.

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The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

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The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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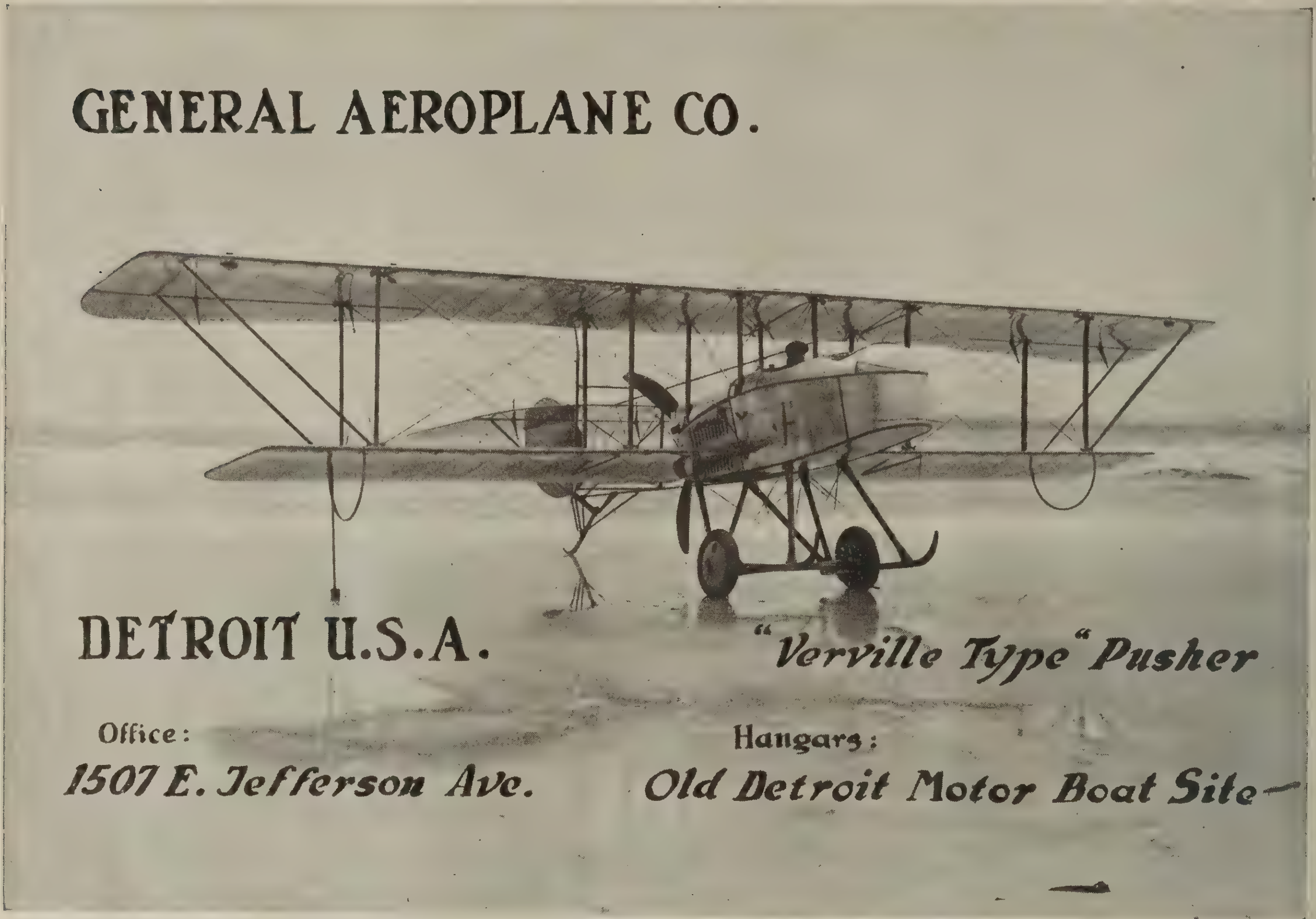
New York Office
Room 327, 42nd St. Building



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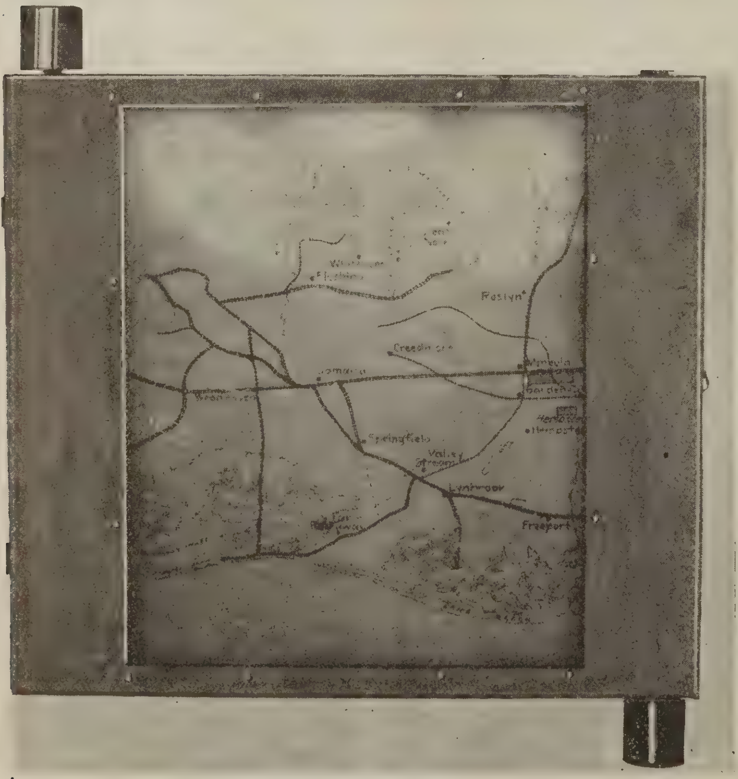

ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps, and Sperry Map Holder, supply this necessity.

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AVIATION TRAINING

THE CURTISS School of Aviation will give training this winter, in Florida, to those civilians who may be accepted by the Aviation Section, U. S. A., upon their having made application for enlistment in the Aviation Reserve Corps. Applicants must be between twenty-one and twenty-seven years of age, possess good health, character and college education or equivalent. Tuition will be paid by the Government.

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CHURCHILL STREET, BUFFALO, N. Y.

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Military aviation training under Aviation Section United States Army supervision at our established schools at Newport News, Va., and Miami, Fla.

America Trans-Oceanic Co., 280 Madison Ave., New York City. New York Agents: R. V. Morris, Coronado, Cal., Pacific Coast Agent.

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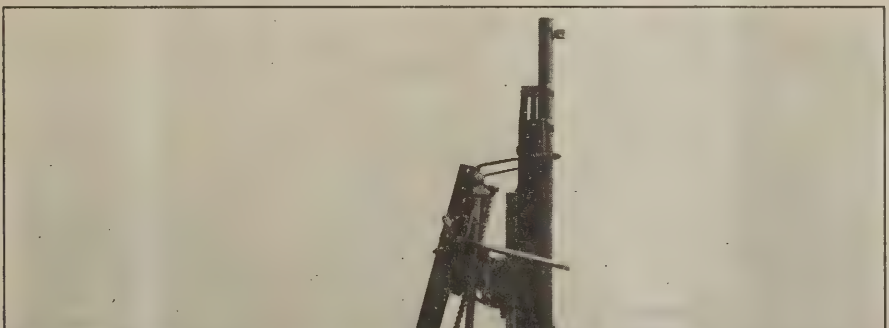
AERIAL AGE
WEEKLY

Vol. 5, No. 7 APRIL 30, 1917 10 CENTS A COPY



The Lawrence machine gun mount, carrying a Colt machine gun and operating at ninety degrees perpendicular, is the latest anti-aircraft equipment and offers a number of advantages for anti-aircraft defence.

*With the Allied forces in the Balkans.
A Lewis Machine Gun in action against
a hostile aeroplane*

U. S. Senator BRADY: "Have we developed a first-class type of machine gun?"

Major-General LEONARD WOOD: "The Lewis gun has been adopted practically unanimously as the light gun of the British service and is being built for the French; and I think it is safe to say, when you see great nations struggling for life adopt a gun, that they are not adopting it lightly."

Transcript from the hearing before the U. S. Senate Military Committee, January 31st, 1917.
From Army and Navy Register

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Tractor Type B. P.

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It fills the urgent need found at present in the aviation schools—giving great range of control and allowing the instructor to be at side of the pupil during flight, thereby facilitating instruction.

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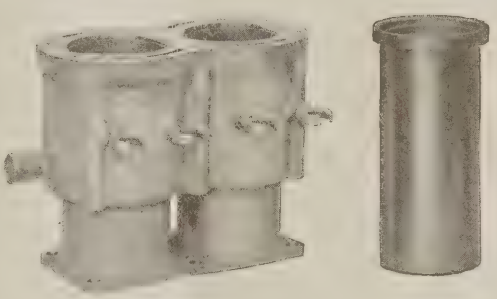

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B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass.

AVIATION TRAINING

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AERIAL AGE
WEEKLY

HENRY WOODHOUSE
Contributing Editor
NEIL MacCOULL, M. E.
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Contributing Technical Editors

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VOL. V NEW YORK, APRIL 30, 1917 No. 7

SEND 5000 AVIATORS TO FRANCE!

ENDORSING a suggestion made by Rear Admiral Bradley A. Fiske, a resolution to train and equip one thousand aviators as soon as possible as the best means to quickly render the most effective service to the Allies, has been adopted by the Governors of the Aero Club of America, and sent to President Wilson, the Chairmen of the Committees on Military and Naval Affairs of the Senate and House of Represnetatives, Secretary Baker, Secretary Daniels, the Council of National Defense and the National Advisory Committee on Aeronautics.

Admiral Fiske's suggestion was made in the following letter to Mr. Alan R. Hawley, President of the Aero Club of America:

"My Dear Mr. Hawley:

"I beg leave to suggest that the Aero Club point out advisability of sending to Europe a large unit of aeroplanes, with trained aviators and appropriate armament.

"One thousand battleplanes, armed with rapid fire guns, bombs and torpedoes, would constitute a combination of power, mobility and control at least equal to that of a hundred thousand soldiers armed with muskets; and that could be more readily transported across the ocean and put to useful work in Europe.

"I am aware of the difficulties of constructing so great a number of large machines; but for such work, the genius of our people and the number and equipment of our factories are especially adapted.

"Sincerely yours,
(Signed) B. A. Fiske,
Rear Admiral, U. S. N. (Retired)."

The Board of Governors' resolution endorsing this suggestion reads as follows:

"RESOLVED: That the Board of Governors of the Aero Club of America endorse the sugegstion of Rear Admiral Bradley A. Fiske that the American Government send to the front as soon as possible a fully equipped aeronautic unit of a thousand aviators, allowing three machines for each aviator, as being the best means in our opinion to quickly render the most effective service to the Allies."

In connection with this it was made public that the officials of the Aero Club of America also endorsed a few days ago the plan submitted by the *London Daily Telegraph* to have the United States concentrate on a plan to send the Allies five thousand aviators as its first military and naval contribution toward assisting the Allies. The *London Daily Telegraph* cabled to New York requesting the opinion of the aeronautical authorities on the subject.

Large Training Camps Could be Established

Mr. Alan R. Hawley, President of the Aero Club of America, gave the following endorsement of the *London Daily Telegraph's* plan:

"Nothing better can be done to assist the Allies than to immediately take steps to train 5,000 American aviators. We have thousands of applications for aviation training from college men who are anxious to join the Army and Naval Reserve to be ready for an emergancy. We also have had a large number of applications from men who would like to join the American Aero Squadron in France or to enter the Royal Air Services. Large aviation training camps could and undoubtedly would be established immediately where students would be given their preliminary training in aviation and in military matters in general. The Aero Club of America has received a large number of offers of extensive tracts of land to be used free of charge for aviation training camps. It has also received liberal offers of funds for establishing aviation training and training aviators in large numbers. But I believe that to give the best results and avoid confusion the training of 5,000 aviators to send to Europe should be undertaken by the American Government. The suggestion comes at the most opportune moment, and you may rest well assured there will be no lack of co-operation in the United States to make the scheme effective. In view of the situation here, one is safe in predicting that of all the forces to be despatched from this side to Europe, the strong probability is that amongst the first would be a large number of representative aero squadrons representing the very best material America can furnish, and all firmed by patriotic enthusiasm at the prospect of flying under the "Stars and Stripes."

Enthusiastic Approval of the Plan

Mr. Henry Woodhouse, member of the Board of Governors of the Aero Club of America, also endorsed the *Daily Telegraph's* proposition as follows:

"I have sounded public opinion regarding the matter of sending a large number of aviators to fight with the Allies and find a general enthusiastic approval of the plan. There will be no trouble to get thousands of volunteers to make up the American Aero squadrons to be sent to Europe. I rather believe that there will be many times more applications than there are wanted. The students from about twenty universities, including Yale, Harvard, Columbia, Princeton, Cornell, Georgia Institute of Technology, are already forming units of the Aerial Coast Patrol, and we have thousands of applications for aviation training on file. There will be no trouble whatever in getting the aeroplanes and equipment needed to train and equip these men, and it would take about ninety days to establish the camps and give the students their preliminary training, including the theory of flight, aerial gunnery, discipline, etc. By that time our American aeroplane factories will be turning out aeroplanes by the hundred. Within six months they will be turning out aeroplanes by the thousands. Everything depends on prompt action by the government reinforced by general public co-operation and with such facilities as we can provide there should be no reason why squadrons fully trained and completely equipped should not leave New York within six months ready for service training, which can only be given on the field of battle."

Aid the Lafayette Aviation Corps

Mr. Augustus Post, Secretary of the Executive Committee of the Aero Club of America, in a speech delivered last Monday evening, prophesied:

"That the first blow struck by Americans on foreign soil would be by aviators sent to aid the Lafayette Aviation Corps, which has already been doing such splendid work at the front." This statement was met with great applause, and it seems the most effective way to send immediate assistance and to strike the strongest blow.

"A canvass has been made of the best fliers in the country," says Mr. Post, "and I understand they have all without exception been willing to volunteer for overseas service, and I also understand that Theodore Roosevelt, who is perfecting plans for the division to be sent abroad, has already made arrangements to include with the men whom he is to lead a fully equipped aerial squadron. I understand officers of the Royal Flying Corps are coming to America to instruct and assist in the training of our air forces and in the development of American machines. The Aero Club of America has received thousands of applications from the best flying material in the country, and the popularity of this branch of the service indicates that there will be no difficulty in securing aviators if the facilities for training are provided. The United States Army are extending their facilities as rapidly as possible for training men and the stations at Mineola and Memphis in the East are taxed to the utmost as well as the private training schools at Newport News and Miami and Palm Beach."

REPORT ON EFFICIENCY OF AMERICAN AEROPLANES MADE CONGRESSIONAL DOCUMENT

THE convincing report submitted by the Advisory Committee on Aeronautics co-operating with the Commander of the Third Naval Reserve Forces has been made a congressional document.

It is known that the authorities who rendered this report had available a vast amount of data of the most authoritative nature regarding the status of aeronautics and the performance of various types in Europe and America and rendered this report after an exhaustive consideration of the situation from every standpoint.

Since the publication of the first report, the Committee has issued a further statement which compares, type for type, the machines constructed in America and in Europe, as follows:

"In the past eighteen months the war has forced a change in the design of aeroplanes; that is, to get greater efficiency and extreme performance, the weights had to be cut down. This, of course, involved greater refinement of detail, and a very considerable reduction of the factor of safety. In fact, factors of safety as low as 3½ instead of the previous 6—8 are being accepted. Further, if these same machines were subjected to what is known as "a sand loading test" (the aeroplane is supported in an inverted position, and sand or shot in bags is piled on the surfaces to approximate the load distribution in flight and increase is made until excessive elongation of parts, in case of tension members, or abnormal deflections are noted, or rupture of any parts occur) it would be found that the factor of safety, thus determined, is far less than the calculated or theoretical factor of say 3½. Further, there is abundant evidence of actual failure of many of these machines in the air, resulting often in fatalities. Cases are on record, particularly with the English machine, of fuselages disrupting in the air under flight loads; tails actually collapsing and breaking off, and even the collapsing of wing structures.

"The French machines, which all along have been sanely developed on the relatively low safety factor basis, are far superior, mechanically, to the general English product, and have much better general attributes and performances.

"Attention should be called, however, to the general excellence of the light weight French motors, which admittedly permit of the great performance of French machines and their superior mechanical qualities. Now, however, motors in America are actually in acceptable production which are the full equal of the best French motors to date. Further, it is of interest to note that a certain engine gives more power than its French prototype, of which it is an exact copy, and all parts interchangeable with the foreign built motor. Some American motors are as good as any abroad. Governor's Island Aero Squadron made about 2500 flights in the past year with only about half a dozen cases of motor trouble.

"Further let us record the fact that we have the talent available in America that can accomplish this task as satisfactorily as the experienced French and English designers and constructors, who can do the job on a real production basis.

"It may be put down as axiomatic in aeronautics that to get performance, one must not see how much you can put on an aeroplane, but how much you can keep off. In other words, in the final analysis, it is low total weight and high horsepower, other things being equal, that gives remarkable performance.

"In the struggle for the supremacy of the air, a premium has been put on speed, and for the sake of speed, machines are turned out with a factor of safety of only two or three. Of course, the factor of safety is of no value if the machine cannot out perform the enemy's machine. But if he will permit American manufacturers to cut down their factor of safety to two or three, and only expect their machines to carry fuel for two hours, we surely can get aeroplanes at least equal to the European machines.

"But we know full well that so long as we have not got to fight off aviators from American skies no one will dare to assume the responsibility of cutting down the present factor of safety of American machines by half. In fact, a minimum factor of say 5 is highly desirable, and will result in most satisfactory performance.

"We who are close to developments and get a lot of information about what they are doing abroad as well as what is being done here, know that American aeronautic engineers can turn out, type for type, machines that are equal to the best European machines. To qualify this statement, there are four types of machines used in number abroad, outside of the large seaplanes in the production of which American manufacturers lead:

"(1) *The training machine:* There are half a dozen manufacturers who can turn out training machines equal to the very best European machines.

"(2) *A machine equipped with motor of between* 120 *and* 200 *H. P. to use for bomb dropping and for spotting artillery fire:* After reading the account of the employment of this type of machine in the raid on the Mauser works, written by one of the members of the Lafayette Corps, who participated, we feel that we have the equivalent of these machins in the two-seater tractors being built by a dozen of manufacturers.

"(3) *The large, slow, bomb carrier,* which is used to carry bombs but is protected during raids by the fast chasers. These machines are either single motored or twin motored. In the raid on the Mauser works they were single motored. In other raids the twin motored have been used. It will be recalled that there never was an order placed for a twin motored land machine in the United States before May 25, 1916, when the Aero Club bought the first twin motored battleplane turned out by the Curtiss Company to send to the Mexican border. Even the European machines, though they carry large loads, have a very slow climbing rate, and no great maximum altitude attribute. Victor Carlstrom flew the first battleplane from New York to Washington on May 25th, with Mr. Alan R. Hawley as passenger, and then the club offered it to the Army, and it was sent to the Mexican border. The Army accepted it in the beginning of June, but it was requested that changes be made in the landing chassis to meet certain conditions to be met at the Mexican border. We asked the Army officers to have the changes made to suit their

(*Continued on page* 233)

THE NEWS OF THE WEEK

Third Yale Air Unit to Train

The third unit of the Aerial Coast Patrol, which was organized a few days ago, with twelve Yale students as members, will begin training immediately at the station recently established by Joseph P. Knapp, president of the American Lithograph Company, at Mastic, L. I.

This is the third patrol unit that has been contributed to the defenses of the eastern seaboard by Yale University. The first was organized some time ago by F. Trubee Davison, son of Henry P. Davison of J. P. Morgan & Co., and Robert Lovett, son of Judge Robert Lovett of the Union Pacific Railroad. This unit, with twenty members, is in training at West Palm Beach, Fla. The second unit, organized by Robert Lovett, G. G. Depew and Frank Goodyear, is training in Buffalo. Other units are being formed in Detroit, Chicago, Marblehead and other cities. The newest addition to the force is expected to be ready for actual service in summer, at which time the aerial patrol system will begin in full swing.

The members of the squadron are: William J. Connors, Jr., Clinton D. Backus, Leslie McNaughton of the Yale crew, Joseph Nagel of the track team, Frank Blossom of the golf team, Capt. Hamilton Gardner of the golf team, David Dunlap, Jack Mitchell, Duncan Forbes, H. Howe, brother of the former football star; and Harold Pumpelly, the gridiron hero who won Yale's game against Princeton three years ago. E. K. Jacquith, the aviator who recently flew from Atlantic City to Miami, will be in charge of the instruction of the students.

Urges Huge Aerial Force to Protect Naval Bases

Major Henry C. Davis of the United States Marine Corps, an expert on scouting flights, has much that is interesting to say concerning aerial defense of isolated naval bases, of which there are many along both the Atlantic and Pacific coasts. Major Davis recommends that air scouts be stationed at all important strategic points. He says:

"The addition of aircraft to the defenses of our naval bases is an imperative necessity.

"Assuming seven hours' endurance, the air scout, at say seventy-five miles an hour, will be enabled to proceed out three hours and return in three hours, leaving one hour for a safety margin. At an elevation of 5,000 feet in clear weather the scout should have a circle of vision the radius of which is approximately seventy miles. He ought to be able also to locate an enemy fleet or a convoy of transports at a distance of 300 miles from the base from which he started. Assuming the enemy speed to be twelve knots—it is more apt to be ten—we have thirty hours' advance notice of his approach.

"The necessity of a much enlarged aerial force for the Marine Corps cannot be too strongly urged."

Offers U. S. Aviation Field

W. B. Strang has offered the aviation field at Overland Park to the United States Government free for use as a training ground for men in the aviation service. There is a steel wireless telegraph station 350 feet high not more than a mile from the field, which Mr. Strang says also might be used in connection with the training. Word has been received from the war department that the offer is being considered.

Atwood with Du Pont Aerial Station

Harry N. Atwood, of the Atwood Aeronautic Company, has been put in full charge of the installation and operation of the new DuPont Aerial Station at Wilmington, Delaware.

Admiral Peary Returns from Pacific Coast

Rear Admiral Robert E. Peary, Chairman of the National Aerial Coast Patrol Commission, returned to Washington April 20th, after a speaking tour of three weeks clear across the country from Washington to San Francisco. He delivered 20 addresses before large audiences in behalf of the Sheppard-Hulbert Bill to create a Federal Department of Aeronautics and a Secretary of Aeronautics. The Washington office of the Aero Club of America reports to AERIAL AGE that scores of telegrams have already been received in behalf of this bill by the entire Congressional Delegations from Illinois, Iowa, Utah and California.

Admiral Peary's principal addresses were in Chicago on April 3. On April 4th, three addresses in Des Moines, Iowa, including one before the joint session of the Iowa Legislature with Governor Harding in the chair, the Bonneville Club of Salt Lake City on April 6, the Aeronautical Society of California in Los Angeles on the 9th, the Navy League of California in San Francisco on the 11th, the Commonwealth Club of San Francisco on the afternoon of the 12th, the University of California on the evening of the 12th, and the San Francisco Press Club on the 13th.

Captive Balloon in Service

The first American captive observation balloon to be manned by a civilian crew went into active training service on Staten Island April 22, with members of the Columbia University Volunteer Signal Corps as its operatives. Major Carl F. Hartman, of the United States Army, one of the few American officers experienced in the work, directed the training. The new unit is the result largely of the efforts of Mrs. Charles A. Van Rensselaer, of No. 130 East Fifty-sixth Street. Under her direction $10,000 has been raised, and with this sum a large eighty-foot sausage balloon has been purchased and other expenses of the unit met.

Training Camp at Marblehead

Boston, Mass.—An aviation base and training camp for airmen of the Naval Reserve force was established recently at Marblehead. The first of 100 officers and men arrived there, and immediately started the work of laying out the new camp. It is the first aeronautical station to be established in the first naval district.

Lieutenant Godfrey L. Cabot, who will direct the activities at the flying school, arrived and immediately started the work of pitching camp. After a consultation with Lieutenant Porter, it was decided that for the present, at least, the men and officers of the aviation squad will be quartered aboard the training ship with the reserve officers and seamen. Flights are expected to start later in the week.

Another detail of the reserves at the Marblehead Neck station has departed for active service. Lieutenant Porter received his second draft order and sent a squad of men for duty aboard ships. The reserves at the camp have two three-hour drill periods daily.

Janney, Steinmetz Receives Order

Philadelphia, Pa.—Janney, Steinmetz & Co., of this city, have received an order for 3,000 hydrogen gas balloon cylinders from the Navy Department. These will be used in the Navy Signal Balloon Service, and are fitted with standard Navy hydrogen high pressure valves.

The meeting of the National Advisory Committee for Aeronautics and aeroplane and motor manufacturers, held in Washington, recently. Some of those in the group are: Dr. Charles D. Walcott, Chairman; Dr. S. W. Stratton, Secretary; Dr. Joseph S. Ames, Dr. Charles F. Marvin, Dr. Michael I. Pupin, Sidney D. Waldon, Dr. W. Christmas, Christmas Aeroplane Company; Mr. G. R. Cockley, International Airship Corporation; Mr. A. H. Flint, Mr. Henry M. Frauenthal, New York Aero Construction Company; Mr. E. F. Gallaudet, Gallaudet Aircraft Corporation; Mr. B. A. Guy, Curtiss Aeroplane Company; Mr. G. H. Houston, Mr. William H. Hutton, Mr. C. M. Keyes, The Curtiss Aeroplane Company; Mr. Glenn L. Martin, Wright-Martin Aircraft Corporation; Mr. H. B. Mingle, Mr. W. B. Judkins, Mr. F. L. Morse, Thomas-Morse Aircraft Corporation; Mr. Israel Ludlow, Mr. C. T. Moore, Seattle, Washington; Mr. F. H. Russell, Burgess Co.; Mr. J. W. Scott, Curtiss Aeroplane Co.; Mr. Henry Harrison Suples, Mr. G. Thomas, Mr. Inglis M. Uppercu, Major C. S. Wallace, Mr. Lee S. Wallace, United Eastern Aeroplane Company; Mr. Harry D. Westcott, New York Aero Construction Co.; Benj. L. Williams, Secretary, Aircraft Manufacturers' Association; Mr. Charles F. Willard, Mr. Samuel Quinn, International Airship Corporation; Mr. Eugene S. Robinson, Mr. Charles B. King, Mr. F. S. Dusenberg, Dusenberg Motor Corporation; Warren S. Eaton, New York Aero Construction Company.

Want Aircraft Materials Inspectors

The United States Civil Service Commission is conducting examinations to fill the position of assistant inspector of engineering material for aircraft. There are at present six positions open, paying from $4.48 to $5.04 per day, and the commission, due to the lack of eligibles and urgent needs of the service, is receiving applications at any time, rating examination papers when received, and will make appointments with the least possible delay. Competitors must have had at least one year's experience as machinist in a factory constructing gas engines for automobile or aeroplane use, or as inspector of aeroplane or automobile engines, or one year's actual experience in flying. In the examination, experience counts 60 points, and education of a technical nature for 40 points out of a total of 100. Applicants are to apply for Form 1,312 to the Civil Service Commission, Washington, D. C., stating the title of the examination.

Harkness Buys Sheepshead Track

The Sheepshead Bay Speedway, New York City, now is in the hands of Harry S. Harkness, its president and chief financial backer. It has been in difficulties for some time. Harkness has purchased the $2,040,000 first mortgage for $1,650,000, and has paid $550,000 in notes bearing his endorsement. Though speedway racing appears to be a thing of the past, at least until the war is over, it is thought that Harkness has made a good investment, as real estate values in the Sheepshead Bay section are thought to be sure to rise.

Detroit as Aviation Center

Detroit—The Aero Club of Michigan has launched a campaign to make Detroit the chief center of the aviation industry in America, and with the immediate object of promoting public interest in air transit and the manufacture of aeroplanes, of bringing a government school to Detroit, of securing an aviation field and of increasing the club's roster to 5,000 or more.

About 800 engineers, manufacturers, mechanics and others accepted application blanks. G. Douglas Wardrop, editor of AERIAL AGE, discussed aeroplanes in Europe, and told of the important part they played in the war.

Motion pictures illustrated every phase of air fighting, and the famous Spad aeroplane was shown, as were photographs of the German Fokker, the French Avions de Chasse and the British triplanes.

Gem May Build Aeroplanes

Grand Rapids, Mich.,—The Gem Motor Car Corp. of this city, has been offered a contract to build 1,000 battleplanes following specifications by French engineers. The contract has not yet been accepted.

Orville Wright in New Aeroplane Companies

Dayton, Ohio. April 14—Orville Wright is listed as an incorporator in two new aeroplane companies formed here this week. The are the Dayton Airplane Co., and the Wright Field Co. The incorporators are the same for the two companies, as follows: Orville Wright, E. A. Deeds, H. E. Talbott and H. E. Talbott, Jr.

Organize Columbia Flyers

The National Coast Patrol Commission has decided to form the 125 students and members of the alumni of Columbia University, who have volunteered for aeroplane service, into the Aerial Coast Patrol Unit No. 4. Clarence Martin, an alumnus, of 52 William Street, organized the Columbia unit, which will have as its instructor Philip Sims, an American aviator who served in the Royal Flying Corps of Great Britain.

The Unit may purchase Howard S. Borden's seaplane for the use of the aviators, and their training ground will be a field on the Shrewsbury River, in New Jersey. It is planned to send six men there next Monday to begin practice. These who do not qualify as aviators may be used as mechanics. More than $6,000 has been subscribed for the use of the Unit.

Miami News

Miami, Fla.—E. H. Holterman, a student of the Curtiss School of Aviation here, finished his course in aviation last week by making a straight thirty-mile flight across country from Miami to Homestead, landing and returning to the starting point, and by so doing becomes automatically a lieutenant in the aerial reserve of the army.

Mr. Holterman, the most proficient pupil of the school, is the first of his class to complete the training and the first graduate from the Miami aeronautical school. Eight of ten others will finish their tests within ten days or two weeks, it is thought.

The flight to Homestead and back was made in one hour and fifteen minutes actual flying time, and fifteen minutes more were passed by Mr. Holterman at Homestead, where Mayor Tatum and several prominent citizens welcomed the first aviator to make a landing in their town.

Sergeant Blake, representing the army, and E. H. Ballard of the aviation company, went to Homestead an hour in advance of Mr. Holterman's arrival and were awaiting him there, when he descended from the low hanging clouds that made his flight somewhat difficult.

Lieuteant Holterman is now awaiting orders from the war department. He has not been informed as to where he will be sent, but is of the opinion that he will be assigned to work as an instructor in the aviation branch of the army.

Princeton Begins Work

Princeton, N. J., April 22—Princeton's aviation school got under way to-day, Lieutenant Edward Kennerson, U. S. A., head instructor, making two flights in a Curtiss aeroplane, the gift of an alumnus.

Four other machines, also the gifts of graduates, are expected to arrive later in the week when instruction will begin.

More than 200 undergraduates have applied for admission to the school. Only about sixty can be accommodated.

Aviation School for Spokane

Spokane, Wash.—A committee of Spokane business and professional men, recently appointed by Mayor Fleming for the purpose of working for a military training camp and an aviation school in the Inland Empire, has left for Coeur d'Alene to meet the recently appointed committee of Coeur d'Alene men.

The Coeur d'Alene committee is composed of F. A. Blackwell, A. A. Crane, A. V. Chamberlain, H. H. Hubbard, Robert H. Elder, Judge R. N. Dunn, C. H. Potts, Judge Flynn, J. C. White and H. Taylor.

"We are anxious to get the co-operation of all people in Washington and Idaho," said Attorney F. C. Robertson of the Spokane delegation, "for the establishment of an aviation school at Coeur d'Alene and a training school elsewhere in the Inland Empire."

S. A. E. Opens Washington Office

Chicago, April 17.—A Washington office of the Society of Automotive Engineers will be opened in the Munsey Building in connection with the Council of National Defense as soon as arrangements can be made. This action, decided upon by the Council of the Society in session here yesterday and today, was brought about by the closer co-operation of the Society with the various Government departments, which work is increasing every day.

The Society is well pleased with the results of its co-operation with the Quartermaster's Department as shown by the specifications of the 1½ and 3-ton military trucks given out this week. The Truck Standards Division of the Standards Committee has assisted the Quartermaster's staff in revising these specifications. Other work, and a great deal of it, remains to be done. It is possible the Society will assist in aviation standardization work, and also in the training of mechanics for aviators as well as in training and supplying mechanics for many other parts of war service.

The Council of National Defense has expressed a willingness for closer assistance by the S. A. E. and the Washington office in this light becomes a necessity. General Manager Coker F. Clarkson, or his assistant Herbert Chase, will probably represent the Society almost continuously in the Washington office.

S. A. E. Summer Meeting to be Held in Washington

New York.—Because of war conditions, the Summer Meeting of the Society of Automotive Engineers, scheduled to be held the last week in June, at Ottawa Beach, Lake Michigan, was called off by the Council of the Society at a meeting held a few days ago in Chicago. An extensive canvass of many connected closely with the activities of the Society showed a general feeling that few of the members could afford the time to spend four days on the east shore of Lake Michigan or at any other place. Each day finds the engineers more and more engrossed in war activities, and correspondingly fewer of the members with spare time for such a meeting.

Instead of four days at Ottawa Beach, it was voted to spend one day on the Summer Meeting,

A group of the American aviators in France, members of the Lafayette Corps, the first unit to take the American flag to the front in Europe.

One of the aviators bombarding New York City with recruiting blanks on "Wake Up America" Day. The demonstration aroused great enthusiasm.

and hold it in Washington, D. C., on Monday, June 25th. Washington was selected because many Government departments are closely associated with the work of the Society.

With one day for a Summer Meeting, instead of three or four, as has been the custom since the start of the Society, the broad program of former years will not be attempted.

Although the Summer Meeting in the sense it has been understood in the past has been called off, the activities of the Society have not been reduced, as such announcement might tend to convey. Instead of the large meeting there will be several smaller and more specific ones.

The tractor engineers, which recently amalgamated with the S. A. E., are confronted with one of the largest problems of the day—the conservation of our agricultural resources and more intensified agriculture. It has been known for a long time that tractor farming means amazingly more than the mere substitution of motor power for animal power. The winter wheat crop situation is a national example of the economic advantage of tractor farming over animal farming. For best winter wheat crops in Kansas, for example, the plowing must be done in July. With horses this month is too hot, and often the ground is too hard. With tractors the heat is no factor. Statistics extending over many years prove the value by increasing yield per acre of tractor farming.

This situation has brought the tractor in international importance and the present demand for increased yield from our farms means perhaps a Government demand for greatly increased tractor production. The lack of standardization in the tractor field as compared with the motor car and motor truck field makes such impossible for a time. The Society faces this problem and its first work in the form of a special meeting will be to get the tractor makers and the Government agricultural interests working together more closely. It is expected that in the near future a meeting to this end will be held. Such meetings will probably take place during the coming summer.

The Summer Meeting of the Standards Committee in Cleveland on May 3d will take on greatly increased importance this year. Besides the 140 men on the various Divisions of the Standards Committee under the direction of Chairman John G. Utz, a call will be made to the members at large of the Society to attend, as the work of standardization is of greatest importance in these days of demand production.

It is possible that a special meeting will be required by the new branch of marine engineering recently amalgamated with the Society and representing motor boat work, such as submarine chasers.

Benoist Activities

The Benoist Aeroplane Company have finished three of their standard 100 H.P., three-passenger boats, which they are now using in the school at Sandusky, and are working on a large 12-passenger boat to be equipped with a single 350 H.P., 12-cylinder Roberts motor. This large machine is to be used in the passenger carrying service between Sandusky and Put-in-Bay. It is contemplated to make a round trip each day during the summer between these two points and one or two round trips a week between Sandusky and Detroit.

Besides these large machines, specifications are going through for a 25-passenger twin-motored Benoist Cruiser to use two of the 350 Roberts. This machine will probably be one of the biggest machines built to date, and will differ to a certain extent from the usual twin-motored machine, inasmuch as both motors are placed in the bow of the boat and a multiplicity of propellers driven from one line shaft, the complete machine being a shaft drive.

Aviators Drop Recruiting Blanks

As part of the "Wake Up America" programme, carried out in New York City, on April 20th, twelve aviators from Governor's Island and Mineola flew over the city, dropping recruiting blanks, urging young men to enlist in some branch of the United States Service. They dropped also petitions for the people to sign calling for universal military training.

Some of the aviators participating were: Bert Acosta, Charles Reid, Captain R. W. Taylor, E. A. Bjorklund, and Captain Martin.

Report on Canada's Flying Schools

Washington.—After six day's stay at the Canadian aviation school, at Camp Borden, Ontario Province, their order for which duty is noted on page 1079 of this issue, Lieut. Col. John B. Bennett, Chief of the Aviation Section, S.C., and Major Benjamin D. Foulois, U. S. A., returned to Washington on April 19th. They reported that the Canadian authorities placed the records of the aviation service at their disposal and gave them all possible assistance in studying the methods of the flying schools.

The Canadian system, much of which probably will be adopted by our aviation corps, is described as follows: Two schools are maintained —one for "cadets" (prospective officers) and the other for "enlisted men," from which ranks are drawn the mechanicians and machinists who form the base and repair forces. On entering the applicant is listed as a "third class mechanic" in each case, the cadet being distinguished by a white band around his cap, a sword-belt in addition to his uniform.

The cadet undergoes one month's instruction in theoretical subjects, at the same time receiving two and one-half hours per day of setting-up exercises. He is then examined and, if passed, goes to "The Wings" where his aviation schooling begins. If unsuccessful in the first examination, the applicant is discharged forthwith. His pay after the first month is that of a private first class.

Instruction in "The Wing" is divided into three classes: Elementary, High and Super-high, corresponding to our "primary," "secondary," and "military," grades. In the first the student receives practical experience in the subjects studied: air stresses, photography, machine gun operation, etc.; in the second he makes short flights with an instructor. He is then examined, both mentally and physically, before passing to the "super-high" course which includes flights without the instructor's assistance or company. Candidates who fail to pass the second class tests are sometimes retained as instructors in the elementary grade but are never promoted to the rank of airmen.

The "ground officers," as those who attend to the detail of office work are termed, are recruited through a separate system and, after three months' instruction, are commissioned as second lieutenants, if successful in their tests. In such cases, they receive the pay of that grade from the date of first enlistment; if they fail in the tests, they are discharged forthwith and receive nothing for the time consumed in preparation. The school maintained by Canada has at present 100 students in the cadet section. The course occupies four months and at its conclusion the students are qualified to start immediately upon active duty.

THE MODERN PAUL REVERE!

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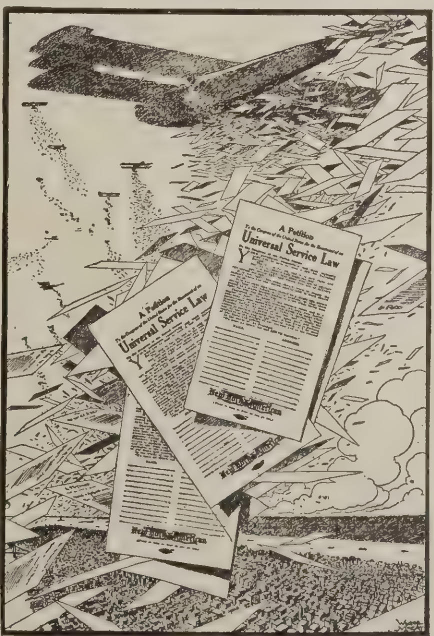


A cartoon from the N. Y. American, whose management arranged the flights over New York on "Wake Up America" Day.

Army and Navy News

The following recommendations as "departmental aviation officers" have been made by Brig. Gen. George O. Squier, C.S.O: Col. Samuel Reber, now detailed to Central Department, to Northeastern Department (Boston): Major Leonard D. Wildman, temporarily detailed to office, C.S.O., to Chicago, vice Reber; Maj r Carl F. Hartmann, from the Eastern Departmert, to the Southestern (Charleston).

Capt. Henry H. Arnold, Sig. Corps, U. S. A., commanding the Signal Corps troops in the Canal Zone, is at present in Washington for the purpose of securing certain new equipment for his units.

It is believed that the War Department will accept the offer of Pierre S. duPont, head of the great powder company, and John J. Raskob, the treasurer, to establish an aviation school at the latter's country estate near Wilmington, Del. The offer included also the initial donation of four hydroaeroplanes to be used in the instruction of men who desired to enter the Flying Corps with the intimation that more equipment would be added if circumstances warranted.

Lewis Machine Gun Endorsed

Discussing the value of markmanship, the London *Times* says: "The superiority of the Lewis machine gun to the German weapon is twofold. Like all our guns, big and little, it is a sounder article than its German rival, is less liable to break down, and has a longer life. It is also superior in rate of fire and in power and range."

THE BURGESS TYPE B. P. PRIMARY TRAINING TRACTOR

At the request of the U. S. Army for a primary training tractor, W. Starling Burgess designed this primary tractor having the seating arrangement side by side, allowing the instructor to be at the side of his pupil, and thereby facilitating instruction. Although it was necessary to make the body wider at the cockpit than usual, it has been accomplished with practically no sacrifice to the appearance and at the same time resulting in a fuselage more nearly streamline in plan.

Simplicity of construction throughout has been given consideration, and in experimental and official trials it has proven itself very satisfactory. Large wing area makes the machine comparatively slow and easy for a beginner to handle, and the confidence a pupil gains by sitting alongside of the pilot in his preliminary lessons is an aid to rapid instruction.

The most noticeable feature of the panel construction is the inclined interplane struts. These are not only staggered forward, but also staggered or tilted outward at angles which are increased the further they are from the center of the machine. The wide spacing of the central struts gives a good forward vision.

General Dimensions

Span, upper plane	41′-6″
Span, lower plane	34′-0″
Chord	6′-6″
Area, main planes	437 sq. ft.
Gap	6′-0″
Stagger	1′-9″
Length overall	23′-11″
Motor, Curtiss Model OX	90 H.P.

Planes

Upper plane is in two sections joined at the center, each section 20′-9″ long. Lower plane in two sections attached to body, each section 14′-10″ long. Area of upper plane without ailerons, 219 sq. ft. Lower planes, 182 sq. ft. Ailerons on upper plane sections have an area of 18 sq. ft. each.

Dihedral angle of both planes, ¾°. Angle of incidence, 1¼°. Upper plane staggered 1′-9″ forward of the lower.

Wing curve is the R. A. F. 3. Forward main wing beam centered 9″ back of leading edge. Beams 4′-0″ apart. Trailing edge 21″ from center of rear beam. Ends of the planes are raked at an angle of 16°.

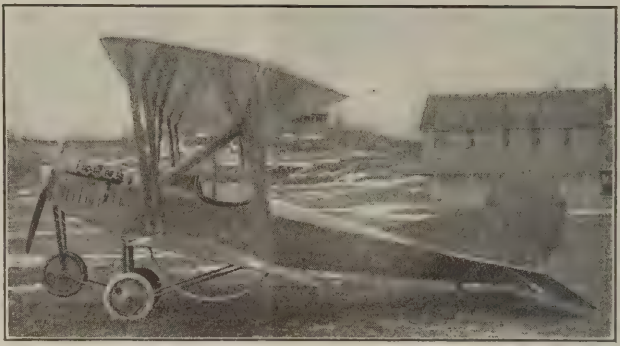
Attachment of the interplane struts on the upper plane is made at the following distances from center: Fuselage struts, 2′-8″ (that is, 5′-4″ apart); Central struts, 9′-1½″ (6′-5½″ from fuselage struts): Outer struts, 16′-9″ (7′-7½″ from central struts). Overhang on either side of upper plane, 4′-0″.

Attachment of interplane struts on the lower plane is made at the following distances from center: Inner edge or root of wing, 2′-1″ (that is, planes spaced 4′-2″ apart); Central struts, 7′-2″ (5′-1″ from inner edge); Outer struts, 14′-5″ (7′-3″ from central struts). Overhang at either side of lower plane, 3′-0″.

Fuselage

Length from front of radiator to tail terminator, 21′-2″. Radiator 27″ wide, 2′-2″ high not including the filler cap. Maximum width of body is at the cockpit, where it is 4′-0″ wide. Depth from bottom of lower longerons of top of upper longerons, 2′-6″. Maximum depth over cowling, 3′-7″.

Upper longerons run back at the level of the line of flight, and 7″ above the center line of propeller. Lower longerons are curved in the forward part, and then run back at an angle to the tail termination, 12″ high.



Side view of the Burgess B. P. Training Tractor.

Landing Gear

The chassis is the 3-wheel type with 26″ disk wheels with 3″ tires. Wheel tread, 5′-4″.

The two main wheels are shock-absorbing, with the axle running in metal guides. The single forward wheel is rigidly mounted.

From the wheels the body is supported by six tubular steel struts, the two forward pairs of which are streamlined with wood. A pair of horizontal rods space the forward wheel hub 3′-1″ in advance of the rear axle.

The tail skid is attached to the body at a point 2′-0″ from the extreme end of the fuselage.

Tail Group

The stabilizing plane is divided, one section at either side of the body. Width 3′-6″. Overall length along rear spar, 14′-0″. Area of the two sections combined, 40 sq. ft.

Elevators or tail flaps, 2′-6″ wide. Distance from tip to tip along trailing edges, 15′-5″. Total Area, 32 sq. ft.

Verticle fin is 6′-0″ long, 2′-6″ high. Area, 15 sq. ft.

Rudder is of the balanced type. Balanced part extends 1′-6″ forward of the pivot; main portion 2′-7″ back of pivot. Maximum height (at rudder post), 5′-6″. Area approximately 13 sq. ft.

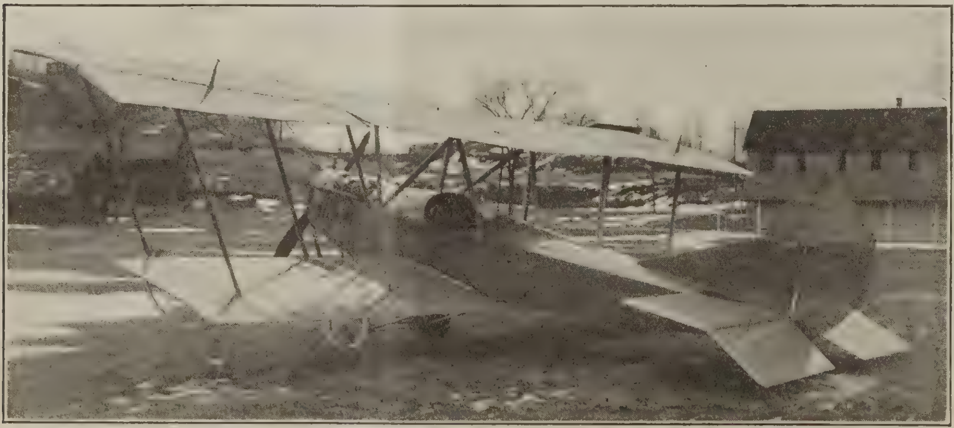
The stabilizer is supported at the leading edge by steel tube braces. Fin and rudder post supported by guys from the rear beam of stabilizer.

Motor Group

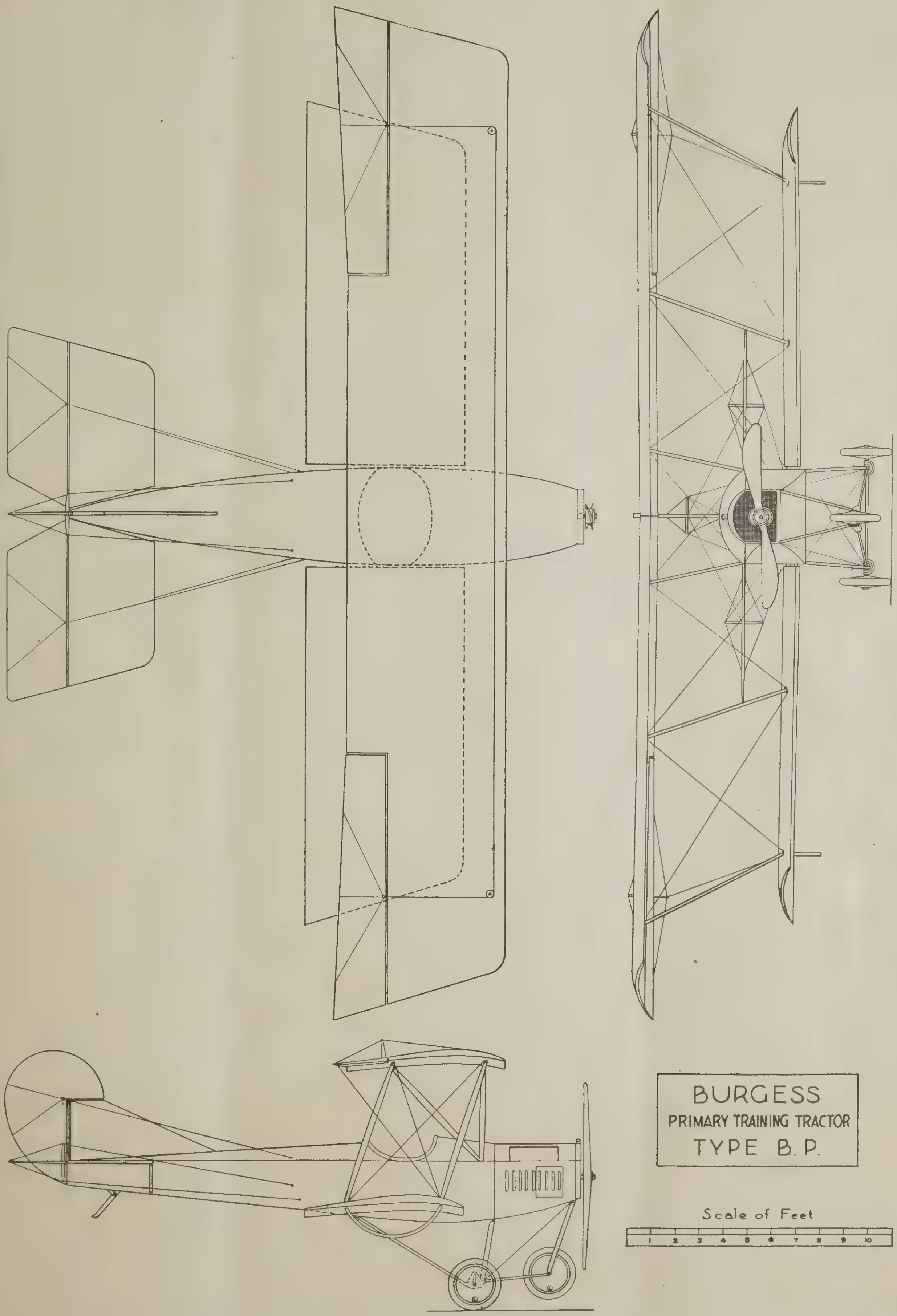
The propeller is 7′-9″ in diameter, directly connected to a Curtiss Model OX 90 H.P. V motor. The Model OX has a bore and stroke of 4″ x 5″; it consumes fuel at the rate of 9 gallons per hour.

Ignition is by a high tension, single spark 8-cylinder magneto located at top of crank case and driven off timing gears at front.

Carburetor is the double "Zenith." Each intake supplies one bank of four cylinders through separate manifolds. Lower end of manifolds water jacketed. Auxiliary air intake in manifolds with hand control for altitude adjustment. Carbretor located under front end of motor, and braced by steel struts to crankcase.



Three-quarter rear view of the new Burgess Training Tractor, showing the staggered strut arrangement.



BURGESS
PRIMARY TRAINING TRACTOR
TYPE B. P.

McLaughlin

D'ORCY'S AIRSHIP MANUAL

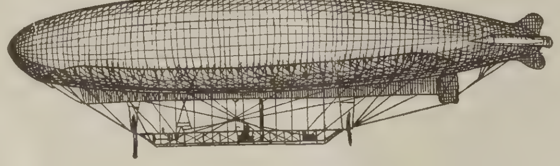
(*Continued from page* 153)

BELGIUM

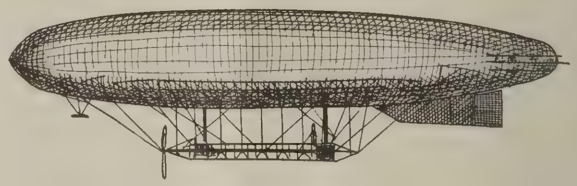
Vivinus Works, Brussels—Builders, to M. L. Godard's designs, of a pressure airship of the keel-girder type. Godard hull. Trim controlled by lifting planes.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**Belgique** (June, 1909)	54.8	9.8	2,700	100	39	Excursion airship of Messrs. Goldschmidt and Solvay of Brussels.—Ballonet: 625 mc. Two Vivinus engines; one tractor and one pusher screws. Best endurance: 2¾ hrs.
1a	**Belgique II** (April, 1910)	65	11	4,000	120	43	Re-built to M. Goldschmidt's designs by the Lembecq Works of Brussels. Car-girder type. Ballonet, heated by engine, 800 mc. One Germain engine; one tractor-screw. Was presented by her owners to the Belgian Army in Sept., 1910; was again re-built and fitted with a hull made by Zodiac and with trimming tanks.
1b	**Belgique III** (May, 1914)	63	11	4,200	120	52	Training airship, Belgian Army. Ballonets: 1,000 mc. Designed endurance: 10hrs.

BELGIUM



Vivinus -"Belgique I" (1909)



Lembecq-"Belgique II" (1910)

BRAZIL

Patrocinio (José de), Sao Paulo—Builder of a pressure airship of the keel-girder type. Carton-Lachambre hull. Height controlled by lifting screws.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (h p)	Speed (k m)	Notes
1	**Santa Cruz** (1903)	45	21	3,900	40		Experimental airship.—One Buchet engine. On the trials the airship failed to leave the ground and was eventually broken up.

DENMARK

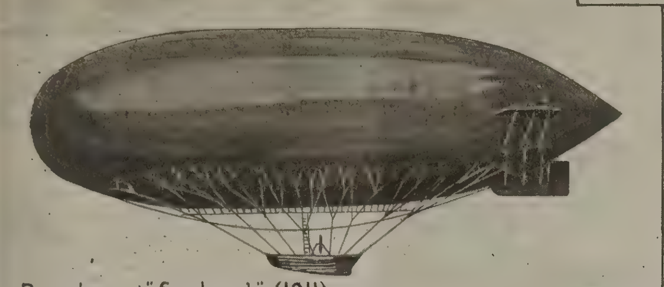
An airship, named **Fionia,** was tested near Copenhagen, in June, 1912. (Photo or sketch and data wanted.)

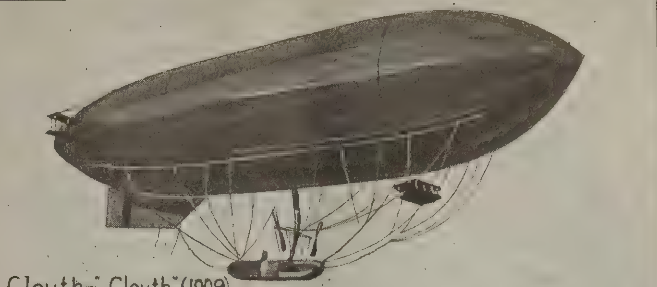
GERMANY

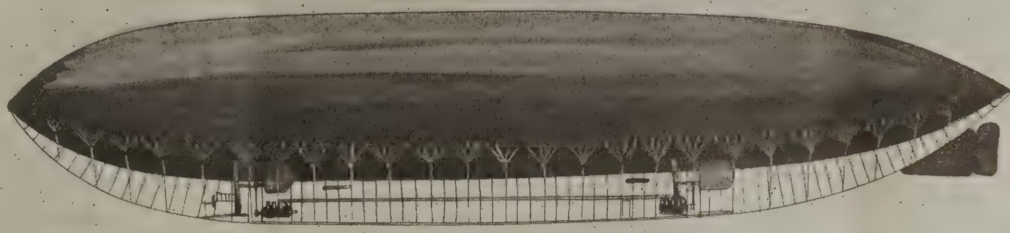
Brucker Transatlantic Flight Expedition, Berlin—Builders of a girderless pressure airship. Riedinger hull; necelle, built like a motor boat, by Lürssen. Trim controlled by lifting planes and a movable weight.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**Suchard** (1911)	60.5	17.2	9,730	220	44	Built for a transatlantic trip from the Canaries to the Lesser Antilles with the help of the trade-winds. Two N. A. G. engines; twin screws. Designed endurance 150 h. with a crew of six.
1a	(1913)	76	17.2	12,000	220	44	One 6 h.p. N. S. U. auxiliary engine, actuating the ballonet blower, the dynamo for wireless telegraphy and the water-ballast winch. Ballonet: 3,600 mc. Was rebuilt after various trials and eventually the transatlantic trip was abandoned.

GERMANY


Brucker -"Suchard" (1911)


Clouth-" Clouth"(1909)


D.L.W. -"Veeh" (1911)

GERMANY—(Contined)

Clouth (Luftschiffbau), Cologne-Nippes—Builders of pressure airships of the keel-girder type. Girder consisting of articulated wooden struts; inserted in the bottom of the hull. Trim controlled by lifting planes.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**Clouth** (August, 1909)	42	8.3	1,720	40	35	Excursion airship.—Ballonet: 344 mc. One Buchet engine; twin-screws. After a few trial trips the airship was rebuilt and re-engined.
1a	(1910)	42	8.5	1,850	50	38	One Adler engine; twin-screws. Best endurance: 150 km. in 4½ hrs. (Cologne to Brussels, June, 1910). Was dismantled in 1912, when the Clouth-Luftschiffbau merged with the Luft-Fahrzeug Gesellschaft of Berlin.

Deutsche Luftschiff-Werft, Munich (Bavaria)—Builders, to the designs of Herr Veeh, of a pressure airship of the keel-girder type. Keel of steel tubing, built into the hull and containing the navigation and engine rooms. Trim controlled by lifting planes and trimming tanks. The company was dissolved in 1914.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**Veeh-I** (1911)	70	12.4	6,780	360	60	Experimental airship. — Ballonet: 1,700 mc. Two Schneeweis engines; two pairs of twin-screws. Was tested with one-half the power plant, but did not prove satisfactory and was re-engined and enlarged in 1912.
1a	(July, 1913)	84.5	12.4	9,100	260	68	Two Mercédès engines; two pairs of twin-screws. Designed endurance: 20 hrs. Made numerous trial trips of short duration, but was broken up for lack of funds and sold at auction in 1914.

Milwaukee to Furnish Aviators

Milwaukee, Wis.—It has been announced at the navy recruiting station that Milwaukee will be expected to furnish six aviators for the flying corps. Applicants must pass a stringent physical and mental test, after which they will be sent to Pensacola, Fla., for training. After eighteen months of practice they will be assigned to duty on ship or shore. Aviators must be between 21 and 30 years of age.

The Wisconsin Defense League, which is the outgrowth of the organization which conducted the recent loyalist meeting at the Auditorium, is assisting actively in securing of recruits.

Missouri Aero Corps

St. Joseph, Mo.—An opportunity for young men to enlist in the navy department for aviation duty only is extended in orders received in this city.

It is urged that candidates be carefully selected, and only those who are particularly capable mentally and physically and between the ages of twenty-one and thirty years be accepted. They will be sent immediately to the aeronautic station at Pensacola, Fla., for training.

Applications will be received at the local station, and it is expected that the number desired will be filled quickly.

J. R. Pendleton, secretary of the local civil service board, has been literally flooded with applications for places in the navy yards and arsenals as mechanics. Pendleton received orders to offer opportunity to mechanics, and he has had more than 100 applications.

FACTORS IN THE DESIGN OF HIGH SPEED ENGINES

By E. H. SHERBONDY

The factors are, in simple—

1. Thermo-dynamic efficiency.
2. Volumetric efficiency.
3. Mechanical efficiency.
4. Speed.

Considering each of these factors in turn and commencing with the thermo-dynamic efficiency, this depends initially upon the air cycle efficiency which is dependent solely on the compression ratio and the ratio of specific heats of mixture.

The specific heat of the mixture during combustion increases with an increase in temperature. As a consequence at the higher temperatures the rise in temperature is less per unit of heat.

Heat is lost through the combustion chamber walls and through the cylinder walls. Something like six times the amount of heat passes through the combustion chamber walls than passes through the cylinder walls.

The important heat loss is only that occurring during ignition combustion and expansion. The heat loss during the exhaust is one which is without the designors control.

In running heat balances for internal combustion engines, the results usually include a considerable error in the matter of heat lost to the cylinder walls by reason of the fact that a large percentage of the heat supposed to be lost to the walls during combustion and expansion is in reality lost during the exhaust stroke. Combustion of course is not instantaneous and is seldom complete, and in the majority of engines owing to the localizing of fuel vapor combustion in many cases proceeds during the entire expansion stroke.

The prime cause of this failure is due to the method of feeding the mixture from carburetors, manifolds and valves into the combustion chamber which would not be the case were the engine operating on gas with the proper kind of mixing chamber.

The maximum air cycle efficiency varies with the compression ratio as has been already pointed out from 42.65 per cent for a compression ratio of 4 to 1, to 47.5 per cent for a compression ratio of 5 to 1, to 51.1 per cent for a compression ratio of 6 to 1.

The true heat loss during combustion and expansion in well designed engines varies from something over 17 per cent at 1,000 r.p.m. to slightly under 16 per cent at 3,000 r.p.m. In any event the variation in the heat loss during combustion and expansion is within very narrow limits where there is anything like good charge compounding.

The limiting values of thermal efficiencies are influenced by the mixture of densities or richness, and when this is translated into terms of foot pounds of energy per cubic inch, it may be said that it is impossible to use a wider range than from 37 to 60 foot pounds of energy per cubic inch of mixture. There is a distinctly rapid falling off in the thermal efficiency as we increase the number of foot pounds of energy per cubic inch, as is instanced by the fact that with a compression ratio of 4 to 1 with a mixture of 40 foot pounds per cubic inch density we may arrive at a thermal efficiency of 28 per cent. With the same compression ratio and a mixture density of 60 foot pounds per cubic inch the thermal efficiency falls off to 20 per ecnt. Again, taking the compression ratio of 5 to 1 we find a considerable increase in thermal efficiency rising to 32½ per cent for a mixture density of 40 foot pounds per cubic inch and 23½ per cent for a mixture density of 60 foot pounds per cubic inch.

Going still further in the matter of compression to a ratio of 6 to 1, we obtain a thermal efficiency of 38½ per cent with a mixture density of 40 foot pounds per cubic inch, and 27 per cent with a mixture density of 60 foot pounds per cubic inch.

These mixture densities correspond to a variation in air to fuel ratio of 14.4 to 16.6 to 1.

The mean effective pressures obtained with a mixture density of 45 foot pounds per cubic inch and compression ratio of 5 to 7, amount to 169 pounds per square inch. If we increase the mixture density to 60 BTU per cubic inch, only 45 will be burnt but the thermal efficiency then will fall to 32 per cent and the mean effective pressure wil increase to 173 pounds per square inch.

Again, with a mixture density of 38 foot pounds per cubic inch and thermal efficiency of 32.2 per cent mean effective pressure will be 147 pounds.

These are probably limiting values for gasoline air mixtures where the gasoline has a heat value of 18,500 BTU.

In the matter of volumetric efficiency this depends largely upon the temperature of the mixture as it enters the cylinder, the frictional resistance of the carburetor, intake passages and ports, and the residual pressure of the exhaust products in the clearance space.

Now note that the degree of the temperature nor the bulk of the exhaust gases have any influence on the volumetric efficiency whatever, that is to say, the volumetric efficiency is absolutely independent of the compression ratio provided there is no appreciable exhaust back pressure.

Owing to the fact that the actual absolute volumetric efficiency can never exceed 82.7 per cent, the indicated mean effective pressure becomes somewhat less than in the values given above and will vary from about 125 pounds per square inch, for a 4 to 1 compression ratio, to about 150 pounds per square inch for 6 to 1 compression ratio.

The volumetric efficiency will fall off due to increased velocities through the valves. Neglecting any other frictional work the efficiency will fall from about 78½ per cent for a gas velocity of 100 feet per second through the intake down to about 63¼ per cent for a gas velocity of 240 feet per second through the intake. This is the case where single valves are used and are disposed in the cylinder head. A much lower curve is secured where the valves are carried in pockets.

Under the head of mechanical efficiency, we may also place those lost through the fluid friction and the most convenient method of considering the losses is in terms of mean effective pressure. The bearing friction remains almost a constant during a very wide range of speed. In fact, it always increases slightly up to 5,000 r.p.m. The fluid pumping losses increase more rapidly, varying from a mean effective of about 2 pounds in well designed engines at 1,000 r.p.m. to about 11½ pounds at 5,000 r.p.m.

The next large loss is the loss due to piston friction, which commences at about 5 pounds at 1,000 r.p.m. and increases to about 22 pounds at 5,000 r.p.m. The points between the values given would form a curve which is nearly a straight line. However, upon adding up these respective losses the inclination of the total mechanical loss is seen to vary particularly as the speed passes about 2,000 turns. All of these losses total up at about 35 pounds mean effective pressure at 5,000 r.p.m. However, at 1,000 r.p.m. they are somewhat under 10 pounds.

Considering the case of a 4-cylinder motor with a compression ratio of 5 to 1 and bore and stroke of 4 inches by 6 inches where the reciprocating parts weigh about .2 pound per square inch (which is exceedingly light), we may secure a mean effective pressure on the brake of about 130 pounds up to 3,000 r.p.m. From this point on the curve breaks rather rapidly and if continued to 5,000 r.p.m. we would find a brake mean effective pressure of about 62½ pounds.

The fuel consumption with a mixture density of 45 ft. pounds per cubic inch works out at about .47 pound at 2,000 r.p.m. and rises very rapidly as the speed is increased beyond 3,000 r.p.m., finally reaching a value of over .7 pound at 5,000 r.p.m.

With this same 4 by 6 motor, which has a displacement of 288 cubic inches, the horsepower may be increased from 80 brake horsepower at 2,500 turns when the inlet valve closes 15 degrees after the lower dead center, to about 140 brake horsepower at 3,000 turns when the inlet is closed from 45 to 55 degees late.

The heat balance which will be arrived at with a fairly well designed engine would probably work out with a loss of 52½ per cent to the exhaust, 15.3 per cent loss due to change in specific heat and jacket loss, 4.7 per cent in mechanical loss, and we finally arrive at a net thermal efficiency of 27½ per cent.

It may be said that the efficiencies and mean effective pressures are quite comparable to those arrived at in Diesel engines. In fact, both the thermal efficiency, and as a consequence the fuel consumption in pounds per horsepower hour may be distinctively better in small Otto cycle engines than in small Diesel engines. The mean effective pressures which can be secured in Otto cycle engines are usually in excess of thos secured in Diesel engines, and the specific power per cubic inch of displacement arrived at is and always will remain many times greater than that which can be secured with a Diesel.

THE NEW ALBATROS DE CHASSE

The Albatros Destroyer is known as the Type D. 1, and the example illustrated was shot down about December 1st, 1916, on the British front.

It carries two machine guns, one at each side of the engine. The fabric of the wings, like the fuselage covering, is painted green and red-brown on top, and pale blue below, similar to other German destroyers.

M. Lagorgette in *"L'Aerophile"* states that though the Destroyer is somewhat massive and heavy owing to the weight of its motor, and has not the speed range of the Nieuport, Morane, Spad or Sopwith, it is very handleable and its armament makes it an adversary seriously to be considered.

General Dimensions

Span, upper plane,	8.6 metres
Span, lower plane,	8.05 metres
Chord,	1.62 metres
Plane area,	25 sq. metres
Gap between wings,	1.15 metres
Length overall,	7.3 metres
Motor, Mercedes	170 H.P.

Planes

Angle of incidence near the fuselage, 5.3° (about 145 mm.) which decreases progressively to 4° at the outside rib of the lower left wing and to 2° at the outside rib of the lower right wing, (about 75 mm.)

Lower wings are fixed to the fuselage on a bracket which sticks out beyond the rounding of the monocoque. The upper plane is in a single unit.

The two main spars are placed near the leading edge, the front spar being 11 mm. from the edge and the rear spar 0.8 m. behind it. There is thus a trailing edge with 0.72 m. overhang, in which the ribs are linked together by a third spar, 15 mm. square in section, which is not attached in any way to the fuselage or the cabane.

The spars, like the wings, finish with an outward slant, and are bevelled off sharply on the top side.

Ribs spaced regularly 415 mm. apart in upper plane, and 350 mm. apart in lower plane, except where interplane struts occur, where the rib is displaced owing to the presence of the compression strut, but where the total interval between the two neighboring ribs is still 700 mm.

Ailerons on upper plane, 2.38 m. in span by 0.41 to 0.52 m. chord. Surface, 1 sq. m. each.

The wings can be staggered as desired. Lower wings fixed in relation to the fuselage, but upper plane can be fixed exactly over the lower or can be staggered forward. For this purpose the horizontal tube which forms the summit of the cabane is pierced at each extremity with 5 holes spaced over a distance of 12 cm. within the limits of which distance the 2 bolts fixing the upper plane can be altered in position. This arrangement is probably made so as to alter the center of pressure to allow for alteration in the size and weight of the motor used, and also possibly for the weight of the pilot. The c.p. is thus shifted longitudinally and the weights correctly adjusted instead of adopting the usual method of merely changing the angle of the tail.

There is a single pair of interplane struts of streamline section on each side of the fuselage. They are parallel to one another, and not diverging.

Fuselage

Length, 6.5 m.; maximum depth, 1.5 m.; maximum width, 0.93 m. There are six longitudinals, two of which are smaller than the others and are fixed half way up the sides. The two upper longerons are not exactly above the lower ones, but are distinctly wider apart. All longitudinals are of spruce except the fore part of the two lower ones, which are of ash as far back as the pilot's seat, where they are 40 mm. deep and 30 mm. thick. They are wrapped spirally with fabric.

To the longerons are fixed simple transverse frames without cross struts. They form the body of the monocoque, and onto them are nailed the three-ply sheeting which covers it. These frames, which are reinforced where they join the longerons are composed of simple laths 20 mm. by 10 mm., rounded on their interior face. Where the tail plane and the fin are fitted in, there are two transverse formers in thicker wood.

Tail Group

The fuselage terminates in a T shape which gives an anchorage horizontally to the tail controls, and because of the enormous thickness of the fixed tail planes (150 mm.), and the fitting of the vertical fin forward, where the fuselage is still very thick, the usual strengthening brackets on the fixed tail are done away with.

In its two parts, without counting the interposed portion of the fuselage, the tail plane has a surface of 1.4 sq. m. There is no incidence angle on the tail plane.

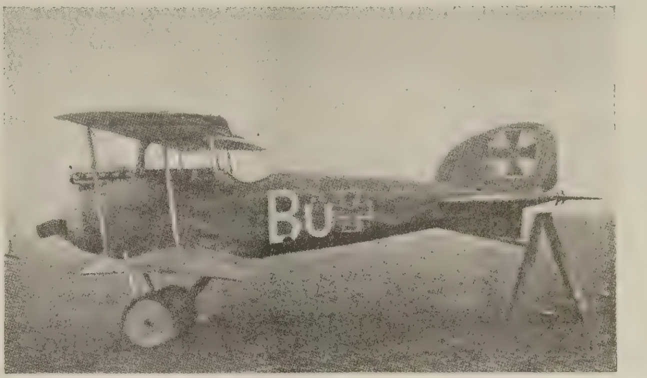
The elevator is a single unit, balanced by a small triangular part projecting forward on the elevator hinge at either end. Surface, 1.1 sq. m., including **0.08 sq. m. of the balanced section.**

Fin surface 0.8 sq. m. (0.55 above and 0.25 below). Their framework, like that on the tail plane, is of wood. The elevator and rudder frames are built of tube.

Balanced rudder, area 0.55 sq. m., including the balanced portion of 0.08 sq. m.

Landing Chassis

Wheel track, 1.8 m. Cross bracing cables are between the rear struts. There is no claw brake.

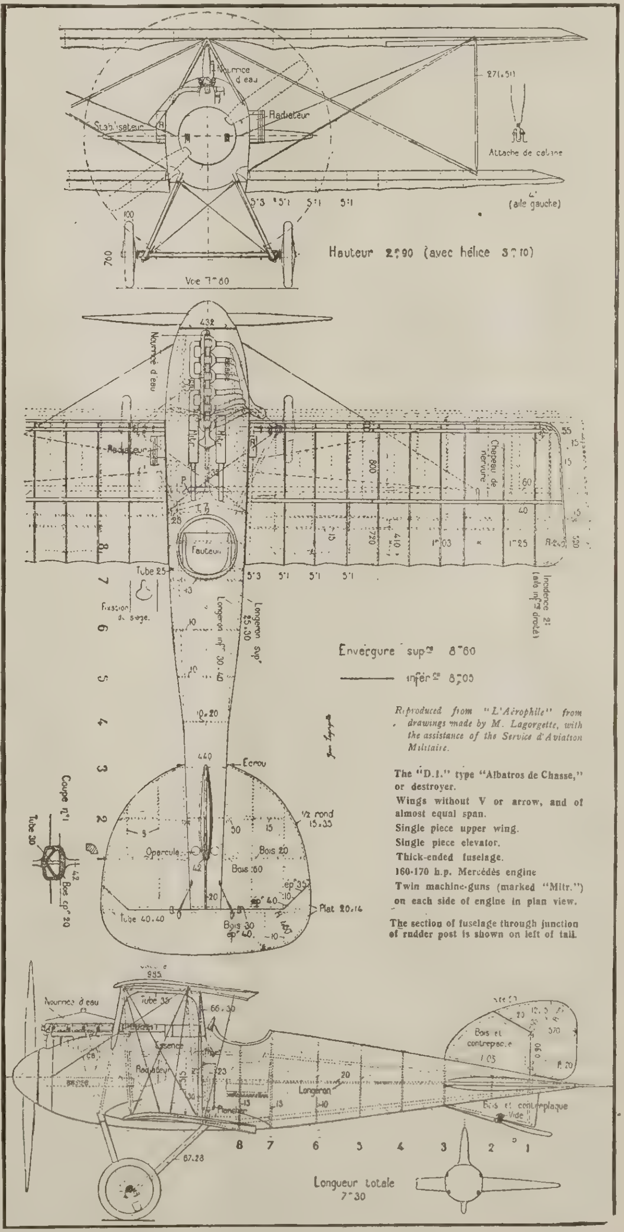


The German "Spad."

Motor Group

Motor, 6-cylinder Mercedes, which gives 170 H.P. at 1,450 r.p.m. The propeller is 2.8 diameter.

The exhaust pipe is pointed obliquely backward and downwards. The two radiators are of a new form, fixed one on each flank of the fuselage outside, one being thicker horizontally than the other. Their position necessitates a gravity tank, flat and triangular, which is located above and to the left of the camshaft. The air pump, with machine gun in front, is fixed above the front of, and not behind, the camshaft.



Reproduced from "L'Aérophile" from drawings made by M. Lagorgette, with the assistance of the Service d'Aviation Militaire.

The "D.I." type "Albatros de Chasse," or destroyer.

Wings without V or arrow, and of almost equal span.

Single piece upper wing.

Single piece elevator.

Thick-ended fuselage.

160-170 h.p. Mercédès engine

Twin machine-guns (marked "Mitr.") on each side of engine in plan view.

The section of fuselage through junction of rudder post is shown on left of tail.

METHODS OF MEASURING AIRCRAFT PERFORMANCES*

By CAPT. H. T. TIZARD, R. F. C.

(*Continued from page* 117)

The aneroid being what it is, one soon comes to the conclusion that the only way to make use of it in aeroplane tests is to treat it purely as a pressure instrument. For this reason it is best to do away with the zero adjustment for all test purposes and lock the instrument so that the zero point on the height scale corresponds to the standard atmospheric pressure of 29.9 ins. or 760 mm. of mercury. Every other height then corresponds to a definite pressure; for instance, the locked aneroid reads 5,000 ft. when the atmospheric pressure is 24.88 ins., and 10,000 ft. when it is 20.70 ins., and so on. If the temperature is noted at the same time as the aneroid reading, we then know both the atmospheric pressure and temperature at the point, and hence the density can be calculated, or, more conveniently, read off curves drawn for the purpose. The observations necessary (after noting the gross aeroplane weight and net or useful weight carried) are therefore: (i) Aneroid height every 1,000 ft.; (ii) time which has elapsed from the start of the climb; and (iii) temperature. To these should be added also (iv) the air speed and (v) engine revolutions at frequent intervals. The observed times are then plotted on squared paper against the aneroid heights and a curve drawn through them. From this curve the rate of climb at any part (also in aneroid feet) can be obtained by measuring the tangent to the curve at the point. This is done for every 1,000 ft. by aneroid. The *true* rate of climb is then obtained by multiplying the aneroid rate by the correction factor corresponding to the observed temperature. These true rates are then plotted afresh against standard heights, and from this curve we can obtain the rate of climb corresponding to the standard heights, 1,000, 2,000, 3,000, etc. Knowing the change of rate of climb with height, the time to any required height is best obtained by graphical integration. The table below gives the results of an actual test.

At least two climbing tests of every new machine are carried out up to 16,000 ft. or over by aneroid. If time permits three or more tests are made. The final results given are the average of the tests and represent as closely as possible the performance on a standard day, with temperature effects, up and down currents and other errors eliminated.

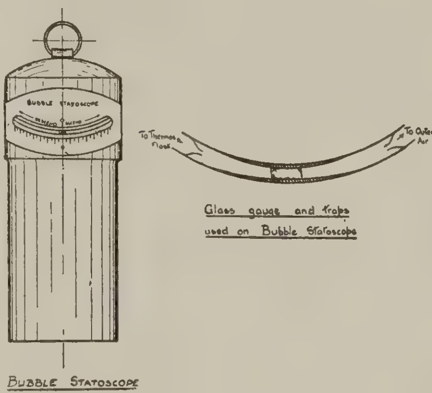
If we produce the rate of climb curve upwards it cuts the height axis at a point at which the rate of climb would be zero, and therefore the limit of climb reached. This is the "ceiling" of the machine.

SPEEDS

His 16,000 ft., or whatever it is, reached, the flyer's next duty is to measure the speed flying level by air speed indicator at regular intervals of height (generally every 2,000 ft.) from the highest point downwards. To do this, he requires a sensitive instrument which will tell him when he is flying level. The aneroid is quite useless for this purpose, and a "statoscope" is used. The principle of this instrument is really the same as that of a climb meter. It consists of a thermos flask connected to a small glass gauge, slightly curved, but placed about horizontally (see Fig. 2). In this gauge is a small drop of liquid, and at either end are two glass traps which prevent the liquid from escaping either into the outside air or into the thermos flask. As the machine ascends and the atmospheric pressure being smaller, and the pressure in the flask being higher than the external pressure, the liquid is pushed up to the right hand trap, where it breaks, allowing the air to escape. On descending the reverse happens; the liquid travels to the left, breaks, and air enters the flask. When flying truly level the drop remains stationary, moving neither up nor down. The instrument is made by the British Wright Co.

The flyer or the observer notes the maximum speed by the air speed indicator—*i. e.*, the speed at full engine throttle. At one or more heights, also, he observes the speeds at various positions of the throttle down to the minimum speed which will keep the machine flying at the height in question. The petrol consumption and the engine revolutions are noted at the same time, as well, of course, as the aneroid height and temperature. Accurate observation of speeds needs very careful flying—in fact much more so than in climbing tests. If the air is at all bumpy observations are necessarily subject to much greater error, since the machine is always accelerating and decelerating. The best way to carry out the test seems to be as follows. The machine is flown first just down hill and then just up hill and the air speeds noted. This will give a small range between which the real level speed must lie. The flyer must then keep the speed as steadily as possible on a reading midway between these limits, and watch the statoscope with his other eye. If it shows steady movement, one way or the other, the air speed must be altered accordingly by 1 m.p.h. In this way it is always possible at heights where the air is steady to obtain the reading correct at any rate to 1 m.p.h., even with light machines, provided always sufficient patience is exercised. The r.p.m. at this speed are then noted.

FIGURE 2



BUBBLE STATOSCOPE

Glass gauge and traps used on Bubble Statoscope

FIGURE 3.

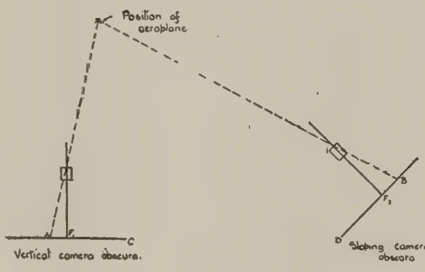
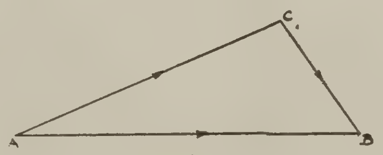


FIGURE 4



A.B represents the measured speed of the aeroplane on the ground.

CB on the same scale represents the Velocity and direction of the wind.

Therefore AC represents the real speed of the aeroplane through the air.

One difficulty, however, cannot be avoided. If at any height there is a steady up or down air current, then though the air may appear calm, *i. e.*, there may be no "bumps," the air speed indicator reading may be wrong, since to keep the machine *level* in an up current it is necessary to fly slightly down hill relatively to the air. Such unavoidable errors are, however, eliminated to a large extent by the method of taking speeds every 2,000 ft., and finally averaging the results.

We must now consider how the true speed of the aeroplane is deduced from the reading of the air speed indicator. It is well known that an air speed indicator reads too low at great heights—for example, if it reads 70 m.p.h. at 8,000 ft. the real speed of the machine through the air is nearer 80 m.p.h. The reason for this is that the indicator, like the aneroid, is only a pressure gauge—a sensitive pressure gauge, in fact, which registers the difference of pressure between the air in a tube with its open end pointing forward along the lines of flight of the machine, and the real pressure (the static pressure) of the external air. This difference of pressure is as nearly as we can judge by experiment $= \frac{1}{2} \rho V^2$ (where ρ is the density of the air and V the speed of the machine), provided that the open end of the tube is well clear of wings, fuselage, etc., and so is not affected by eddies and other disturbances. Now, assuming this law, air speed indicators are graduated to read correctly, as I have said above, at a density of 1.221 kgm. per cubic metre, which we have taken as our standard density and called "unity." It corresponds on an average to a height of about 800 feet above sea level.

Then suppose the real air speed of an aeroplane at a height of "h" feet is V m.p.h., and the indicated air speed is 70 m.p.h., this means that the excess pressure in the tube due to the speed is proportional to 1×70^2,

$$\text{or } \rho \times V^2 = 1 \times 70^2,$$

where ρ is the density at the height in question, expressed as a fraction of the standard density. To correct the observed speed, we therefore divide the reading by the square root of the density. Thus, observation of the maximum speed of an aeroplane at a height of 8,000 ft. by the locked aneroid gave 80 m.p.h. on the indicator, the temperature being 31° Fahr. From the curve we find that the density corresponding to 8,000 ft. and 31° is 0.85 of standard density. The corrected air speed is therefore:

$$= \frac{80}{\sqrt{.85}} = 86.7 \text{ m.p.h.}$$

This "corrected" air speed will only be true if the above law holds, that is to say, if there are no disturbances due to the pressure head being in close proximity to struts or wings. It is always necessary to find out the magnitude of this possible error, that is, to calculate the air speed meter, and the only way to do this is to measure a real air speed at some reasonable altitude for easy observation of the aeroplane by actual timed observations from the ground, and from these timed results check those deduced from the air speed indicator readings. This calibration is the most important and difficult test of all, since on the accuracy of the results depends the accuracy of all the other speed measurements. It can either be done by speed trials over a speed course close to the ground, or when the aeroplane is flying at a considerable height above the ground. In the Testing Squadron we have always attached much more importance to the latter method, mainly because the conditions approximate more to the conditions of the ordinary air speed measurements at different heights, and because the weather conditions are much steadier and the flyer can devote more attention to flying the machine at a constant air speed than he can when very close to the ground.

One method is to use two camera obscuras, one of which points vertically upwards and the other is set up sloping towards the vertical camera. At one important testing center the cameras are a mile apart, and the angle of the sloping camera is 45°. By this arrangement, if an aeroplane is directly over the vertical camera it will be seen in the field of the sloping camera if its height is anywhere between 1,500 and 15,000 feet, although at very great heights it would be too indistinct for measurements except on a very clear day. The height the tests are usually carried out is 4,000 ft. to 6,000 ft.

The aeroplane is flown as nearly as possible directly over the vertical camera and in a direction approximately at right angles to the line joining the two cameras. The pilot flies in as straight a line and at as constant an air speed as he can. Observers in the two cameras dot in the position of the aeroplane every second. A line is drawn on the tables of each camera pointing directly towards the other camera, so that if the image of the aeroplane is seen to cross the lines in the one camera it crosses the line in the other simultaneously. From these observations it is possible to calculate the height of the aeroplane with considerable accuracy; the error can be brought down to less than 1 part in a 1,000 with care. Knowing the height, we can then calculate the speed over the ground of the aeroplane by measuring the average distance on the paper passed over per second by the image in the vertical camera. If x inches is this distance, and f the focal length of the lens, the ground speed is $x \times h / f$ feet per second.

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* Lecture delivered before Aeronautical Society of Great Britain.

It is necessary to know also the speed and direction of the wind at the height of the test. For this purpose the pilot or his observer fires a smoke puff slightly upwards when over the cameras, and the observer in the vertical camera dots in its trail every second. The height of the smoke puff is assumed to be the same as that of the aeroplane—it probably does not differ from this enough to introduce any appreciable error in the results. The true speed through the air is then found graphically as shown in Fig. 4. Here the length AB represents the ground speed of the aeroplane as measured in the camera and CB represents on the same scale the velocity and direction of the wind. The length AC represents, also on the same scale, the true air speed of the machine.

The tests are done in any direction relative to the wind, and generally at three air speeds, four runs being made at each air speed.

The advantages of this method are:

(1) Being well above the earth the pilot can devote his whole attention to the test.

(2) Within reasonable limits any height can be chosen, so that it is generally possible to find a height at which the wind is steady.

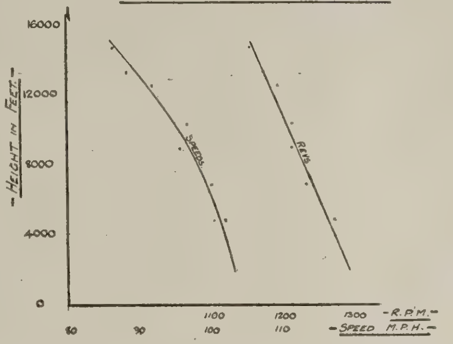
(3) It does not matter if the pilot does not fly along a level path so long as he does so approximately. What is more important is that he should fly at a constant air speed.

(4) It is not necessary that there should be any communication between the two cameras, although it is convenient. The two tracks are made quite independently, and synchronized afterwards from the knowledge that the image must have passed over the center line simultaneously in the two cameras.

The main disadvantage is that somewhat elaborate apparatus is necessary, but this is of not much importance in a permanent testing station. There are often periods in war time, however, when an aeroplane has to be tested quickly, and low cloud layers and other causes prevent the camera test from being carried out. It is then necessary to rely on measurements of speeds near the ground for the calibration of the air speed indicator. In this method the aeroplane is flown about 10 ft. off the ground, and is timed over a measured run. There are two observers, one at each end of the course; when the aeroplane passes the starting point the observer sends a signal and starts his stop-watch simultaneously; the second observer starts his stop-watch directly he hears the signal, and in his turn sends a signal and stops his watch when the aeroplane passes the finishing point.

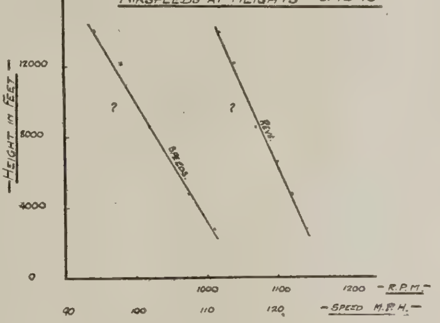
-FIGURE 5-

-AIRSPEEDS AT HEIGHTS 27. 12. 16-



-FIGURE 6-

-AIRSPEEDS AT HEIGHTS 9. 12 16-



By this double timing, errors due to the so-called "reaction time" of the observers are practically eliminated, for the observer at the end of the course tends to *start* his watch late, while the first observer *stops* his late. The mean of the two observations gives the real time. Four runs, two each up and down the course, are done at each air speed, the pilot or his observer noting carefully the average air speed during the run. Observations of the atmospheric pressure and temperature from which the density can be obtained are also taken. The average strength and direction of the wind during each trial are noted from a small direct reading (or recording) anemometer and the speed corrected in the same way as in the camera tests. If there is a strong cross wind the aeroplane may have to be pointed at a considerable angle to the course, and this makes the test a very difficult one to carry out well. Generally speaking, it is only reliable when the wind is quite light, not more, at any rate, than 10 m.p.h. Even this is too strong if it is a cross wind.

A further difficulty is that at high speeds, over 100 m.p.h., an aeroplane may take quite a considerable time to accelerate up to a steady speed, and so it must fly level for a long distance each end before reaching the actual course. At the testing station previously alluded to the course is a mile long, and there is a clear half-mile or more at each end, but it is doubtful whether even this distance is enough for the machine to attain steady speed before the starting point. Finally, the flyer of a single-seater is generally too busy watching the ground to do more than glance at his air speed indicator more than a few times during the run. Doubtless it would be better in such a case to use some form of recording air speed instrument, although then other difficulties would arise.

Having got the true air speed from camera or speed course tests, and knowing the density at the height at which the test was carried out, we obtain what the air speed indicator should have read by multiplying the measured air speed by the square root of the density. By comparing this with the actual reading of the indicator we obtain the necessary correction. The whole procedure may be shown best by a table giving part of the results of a camera test made at the beginning of the year.

A summary of the complete speed tests may now be given. Firstly, the air speed and engine revolutions are noted flying level at full throttle every 2,000 feet approximately by aneroid. From the aneroid reading and temperature observation at each height the density is obtained. The reading of the air speed indicator is then first

(*Continued on page* 231)

TABLE IV

Machine............................ Engine...... ....

Date 27/12/16

Height in Aneroid ft.	Observed temp.	Percentage of standard density	Observed time	Rate of climb in Aneroid ft.	Real rate of climb (corrected for temp.)	Standard height	From curve % of standard density	Time	Rate of climb
0	36° Fahr.		0.0						
1,000	37° "	101.0	1.0	835	814	1,000	99.40	1.20	775
2,000	38° "	97.2	2.10	735	718	2,000	96.30	2.56	685
3,000	36° "	94.0	3.70	640	622	3,000	93.26	4.11	610
4,000	36° "	90.7	5.40	560	544	4,000	90.25	5.85	545
5,000	36° "	87.4	7.25	510	495	5,000	87.35	7.80	490
6,000	33° "	84.7	9.40	450	435	6,000	84.50	9.96	435
7,000	30° "	82.1	11.90	405	389	7,000	81.80	12.40	385
8,000	26° "	79.9	14.25	365	347	8,000	79.16	15.14	345
9,000	22° "	77.6	17.00	330	312	9,000	76.55	18.20	310
10,000	23° "	74.7	20.25	310	294	10,000	74.00	21.61	280
11,000	21° "	72.2	23.60	280	264	11,000	71.70	25.41	245
12,000	20° "	69.8	27.40	230	216	12,000	69.50	29.81	210
13,000	17° "	67.7	31.90	195	182	13,000	67.32	35.13	170
14,000	12° "	65.9	37.90	150	139	14,000	65.17	41.88	130
15,000	8° "	64.1	45.25	110	101	14,500	64.11	46.23	105

TABLE V

Calibration Test of Air Speed Indicator No............ On......................Machine Date, 24/12/16

Run No.	Measured ground speed	Measured wind speed and direction	Corrected true (= V) air speed	Observed Aneroid height	Observed temp.	Density (= ρ) referred to standard density	Observed air speed	$V \times \sqrt{\rho}$	Correction necessary
1	59.1 m.p.h.	31.0 m.p.h. 161.5	89.2	5,100	31	0.879	80.0	83.6	× 3.6
2	123.4 "	28.6 " 5.5	93.7	5,100	31	0.879	85.0	87.8	× 2.8
3	62.0 "	32.3 " 168.5	93.8	5,050	31	0.881	85.0	88.1	× 3.1
4	124.7 "	32.3 " 21.0	95.6	5,000	31	0.882	86.0	88.8	× 2.8
									Mean × 3.1

TABLE VI

AIR SPEED AT HEIGHTS 27/12/16

Aneroid height	Temp. observed	Standard density	Corresponding Standard height	Observed air speed	Corr. for calibration tests	Corr. for density	Observed R.P.M.
3,000	39° F.	.935	2,900	95 m.p.h.	98	101½	1,280
5,000	35°	.875	4,900	93 "	96	102½	1,280
7,000	30°	.821	6,900	88 "	91	100½	1,240
9,200	24°	.767	9,000	81 "	84	96	1,220
10,800	19°	.731	10,400	80 "	83	97	1,220
12,800	17°	.682	12,600	72 "	76	92	1,200
13,800	12°	.664	13,400	68 "	72	88½	1,180
15,200	8°	.636	14,800	65 "	69	86½	1,160

FINAL RESULTS FROM CURVE

Standard height	Air speed	R.P.M.
3,000	103.0 m.p.h.	1,290
6,500	100.5 "	1,250
10,000	96.5 "	1,215
13,000	94.5 "	1,180
15,000	86.0 "	1,160

FOREIGN NEWS

ARGENTINA

Buenos Ayres—The Argentine military aviator Corporal Fels, who has made some notable records in flying, has decided to enlist in the Aviation Corps of the American army. Fels has asked permission of the War Minister, who is said to be favorable to the project.

AUSTRIA

The official statement of the Austrian War Office for April 21 is as follows:

In connection with Entente air raids on suburbs of Trieste, which caused no considerable damage, a squadron of Austrian naval aeroplanes before daybreak on April 20 dropped bombs on the military works of San Canziano, southwest of Gorizia.

A large fire was caused, the statement adds, and all the machines returned safe.

FRANCE

Paris—The French Lieutenant attached to the Lafayette Escadrille, composed of the American aviators with the French army, told the correspondent of *The Sun* that he had charge of the investigation of the circumstances of Edmond Genet's death.

The American's aeroplane apparently had been damaged by German anti-aircraft artillery fire, he said. Genet tried to return to the escadrille's quarters, but his machine was so damaged that it fell near Ham, within the French lines. The body was found and buried in the Ham cemetery.

The Lieutenant was deeply affected by Genet's death. "He was our Benjamin, beloved by us all," he said. "Our only reproach against him had been his reckless daring, which was greater even than McConnell's. Had he lived, he would have accomplished great things."

German aviators are using the adoption of a special escutcheon as the insignia of the American Escadrille on their airplanes, in an attempt to deceive the Allies as to the true nationality of their own airplanes.

Heretofore all the Allies' machines—British, Belgian and French, as well as American—had painted on their planes a red circle inclosing a white circle, with a blue ball in the center. Since the American insignia was adopted providing for a blue star instead of the blue ball, the Germans changed their insignia from the large black cross to a small one in the center of the ring, thus hoping the Allied aircraft will not fire upon them, and that Allied machines may approach them, thinking them friendly.

Several German machines so marked already have been brought down, as the Allied aviators and gunners distinguish the enemy machines by construction details, disregarding the painted insignia.

Paris, April 22—Reports reached Paris today that William Dugan, an American aviator who has been at the front flying with the American Escadrille for about a month, is missing.

Dugan started out on reconnaissance work in the neighborhood of St. Quentin yesterday and failed to return before dark. There is a chance he alighted on the field of some other escadrille, or even strayed into the British lines adjoining toward the northward.

He hails from Rochester, N. Y., and early in the war came over as an ambulance driver for the American Ambulance Hospital. This was not active enough for him, however, and before long he enlisted in the Foreign Legion, volunteering, after nearly two years' service in the trenches, for the aviation service.

GREAT BRITAIN

London, April 18—In the House of Commons today it was suggested that the British Government should appeal to the United States to concentrate on the construction of aeroplanes. John L. Baird, representative of the Air Board in the House of Commons, replied:

"The subject already is under consideration by the Government of the United States."

British Headquarters in France, April 22—Here is the record of a single flight of one of our airmen, made within a few days. I have cut out only the names and other small details which might conceivably be useful to the enemy. Otherwise the record is precisely as the aviator wrote it:

"When our machines were attacking Cambrai I attacked a hostile aviator at a height of about 7,000 feet. I saw that I had hit his engine as we closed and half looped to one side of him. Then he dived, with a long trail of blue smoke. I dived after him to about 4,000 feet and fired fifty rounds into him, when he went down absolutely out of control. I watched him spinning down 1,000 feet, his trail of smoke increasing.

"I was immediately attacked by three enemy machines, which drove me down to a height of only 200 feet. We were firing on one another whenever possible. When at last I got into a good position I attacked one of them from above, having another on my right. I closed on the latter, turning in on him so close that I could actually get a sight on the pilot's head. I saw one of my bullets strike his head, and the machine then simply heeled over and fell to the ground. The other two machines cleared off.

"Having lost sight of the other machines I decided to fly home very low, about 200 feet. A troop of German cavalry going east along a small road halted and fired at me, and also several machine guns opened fire on me from the ground.

"After going west for about five minutes I was again attacked by an enemy single seater. As he approached I rocked my machine until he was within fifty yards. Then I sidelooped over him and fired a short burst at him. He seemed to clear off, and then attacked me again. These operations were repeated several times with slight variations in the way I looped over him until, within about five minutes of the time of crossing the line (flying against a strong wind) when he was about 150 yards behind, I looped straight over him.

"Coming out of the loop, I fired a good long burst and saw where I hit the pilot in the back, just over the edge of the cockpit. He immediately dived straight to the ground.

"I then went over German trenches filled with soldiers. I was fired on by machine guns, rifles and small field guns. There was a lot of artillery firing going on, and many of our shells were bursting about the German trenches, somewhere in the vicinity of the Cambrai road. I saw many small companies of infantry and cavalry, going east along the small roads, but noted no convoys or movements of artillery.

"I landed at the first aerodrome I saw, for my machine was badly shot about."

During the battle, besides the daily job of observation of the enemy's guns and positions, our airmen continually fly far into the enemy's country. In the last few days alone they have dropped twenty-seven tons of explosives on enemy stations, depots and stores and positions of all kinds. They have gone down close to earth and sprayed the German trenches and roads with machine guns.

ITALY

The Italian account of the sea and air battle near Venice on April 17 says:

"A number of aeroplanes, aided by torpedo boats, approached Venice on April 17 in order to effect a reconnaissance in force. A rapid counter attack by Italian and French aeroplanes and the fire of our batteries prevented the enemy machines from flying over the city. In a series of aerial duels one enemy aeroplane was shot down. Two Italian hydroplanes have failed to return to their bases."

JAPAN

(From the *Japan Times* of March 17)

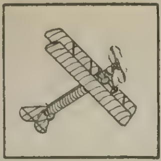
By way of expressing its deep sorrow over the tragic death of Captain Sawada, military aviator, which took place a few days ago at Tokorozawa, the Imperial Aviation Association has presented the sum of 500 yen to the family of the lamented military aviator.

It is also reported that the Association, in the name of Marquis Okuma, the President, has sent a telegram of sympathy to Lieutenant-Commander (not Major, as previously reported) Isobe who, as reported, sustained injuries at the French front recently.

Opinions are now gaining ground among the military authorities advocating the establishment of an official aviation school in view of the present aerial situation in Europe, reports the Tokyo *Mainichi*. The authorities are reported to be making investigations for this purpose.

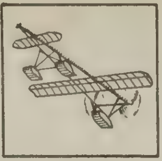
MEXICAN PILOTS AND AEROPLANES AT THE NATIONAL AERODROME AT VALBUENA, MEXICO

From left to right: Adolfo Vazquez, Chief of the Workshops; Lieut. Erasto Carranza; Mechanic, Enriquez; Pilot Aviator, Horacio Ruiz; Captain, Bulmaro Guzman; Pilot Aviator, Capt. Felipe Carranza; Sub-Lieut., Rafael Altamirano, and Sub-Lieut. Medardo Cordoba.



MODEL NEWS

Edited by G. A. Cavanagh



Paper Model Aeroplanes in the Making

(*Continued from page* 195)

Now we are ready for the chassis and weight. The writer has found that a visiting card is very serviceable for the former. Fold it in half and cut out any form somewhat similar to that shown in Fig. 6, and bend as in 6*a* (front elevation).

The two sides can now be separated by cutting along the fold from A to B.

Next cut off a piece of 3/16-in. square wood, 3 ins. long, and make a slit in the centre of one end ¾ in. long, and after placing chassis in position (one half on each side of body), fix weight over it, and this will keep it in place. The construction of the model is now finished.

It is advisable to give the planes a slight camber by the leading edge, but no angle of incidence, as, in the writer's opinion, it is of no use for a model in which no power is exerted.

Fig. 7 shows the finished model.

If the machine has been constructed as shown it should make very good glides, *but on no account should it be thrown, but gently released from the hand with a slight forward motion.* I find it best to launch the models from a window of my house which overlooks a field; then I can get quite long and steady glides. After a few experiments with this type, the beginner will soon be able to make tractor biplanes, Taube or other monoplanes, or Dunne biplanes, using the same method of construction, but in the case of the biplanes substituting struts instead of the under bracings or "load wires" as described. Working on these lines I have made many different types up to about 1 ft. in span, and on one of my tractor biplanes I fitted a small carved propeller with some success. It certainly added considerably to the model from an appearance point of view.

Lastly, a few hints on flying these particular models.

1. Don't throw away a model because it won't fly the first time. Try different weights and positions of same, and tune it up.
2. Rather have too much *head* weight than too little. In the latter case the machine will be unstable; in the former it will fly fast if the elevators are adjusted.
3. Camber only serves to stabilize the machine. Contrary to theory, it does not increase the lift on these machines (they have no power), but rather tends to decrease it.
4. Don't expect your model to "loop the loop." It will not do so unless thrown against a high wind. That is not gliding.
5. Don't fit useless accessories; they simply hamper the machine's progress. A chassis is all right, but there is really no need for wheels.—*Courtesy "Flight."*

Model Clubs Attention

A letter has been received from Mr. W. H. Logue, Jr., 931 North Broadway, Baltimore, Md., in which he requests that we notify the secretaries of the various model clubs to send him information concerning models and the holding of contests.

We need not emphasize the opportunity that is afforded to the clubs to co-operate for the good of the game, and we ask all model flyers collectively or individually whose desire it is to help broaden the field of model aeronautics to send Mr. Logue all information, descriptions, photographs, etc., that they have in their possession concerning model aeroplanes and the holding of contests. In conclusion we would state there is no time like the present.

Boy Scouts Active with Models

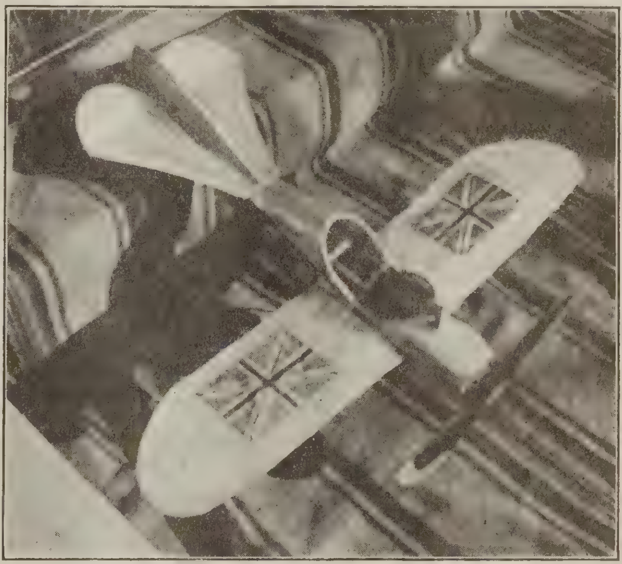
Indianapolis, Ind.—Model aeroplane contests in which model aeraplones made by Boy Scouts were tested for distance and duration of flight were held at the state fair ground April 6th in connection withe the celebration of Scout Week in Indianapolis.

A Model Warplane

The model shown in the accompanying photograph was constructed by Master R. O'Neill, of Montreal, Canada. The machine was designed after one of the leading warplanes now in active service abroad and in carrying out the entire features he did not fail to include the identification marks which are of utmost importance in the war zone.

The dimensions of the model are as follows: Length of fusilage, 23 inches; span of top wing, 33 inches; span of lower wing, 29 inches, both having a chord of 7 inches. Motive power is derived from two ⅛-inch square elastic strands which operate a multiple gear to which is attached a ten-inch propeller.

In coloring the model a dull aluminum was selected. Complete the model weighs 12 ounces. Perhaps the most interesting feature of the model is the ability to change it to a monoplane by the removal of the upper wing after which the lower wing is raised to the sockets in the fusilage which were especially arranged for that particular purpose.



Model warplane.

The Broadway Model Aero Club, Baltimore, Md.

A meeting of young men interested in the sport of model aeroplane flying was held in this city on Tuesday, April 10, at the office of Mr. William H. Logue, Jr., 931 North Broadway. At this meeting a permanent organization, which will be known as "The Broadway Model Aero Club of Baltimore, Maryland," was formed. This club will, from this time forward, hold regular meetings at which scientific construction and flight articles by authorities in this matter, etc., will be discussed intelligently and interestingly.

At the last meeting the officers were elected. Also an article by one of the leading authorities in the United States, concerning the construction of these models, was read by the secretary of the club.

Model planes are now being constructed by all of the members of the Broadway Aero Club. Exhibition flights will be arranged and contests will be held at an early date in one of the public parks.

The Broadway Model Aero Club now consists of ten members, all of whom are very enthusiastic regarding the outcome which they are certain will "bring Baltimore into the limelight." A campaign is now under full sway to increase the membership of the club. This campaign is being conducted by the membership committee, Masters Black, Borgfeldt and DeLauder. Any young man of good character and interested in aeronautics is eligible for membership. Apply to the secretary, C. Howard Black, 927 North Broadway, who will refer the matter to the membership committee at the following meeting.

Officers: President, Charles J. Koch; Vice President, Justice F. Mueller; Second Vice President, Robert E. Borgfeldt; Secretary, C. Howard Black; Treasurer, Thomas DeLauder.

Membership Committee: C. Howard Black, Robert E. Borgfeldt, Thomas A. DeLauder.

Contests Committee: Charles J. Koch, Justus F. Mueller, Ernest Schneider.

Director: Mr. William H. Logue, Jr.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

The New Slang

Every industry or sport must have its own little slang words and phrases. Just as in baseball the runner "Purloins the second hassock," instead of merely "Proceeding to second base before the spheroid can be propelled thither by one of his opponents," in football the giant full-back "hits the line for ten yards."

All this slang we are acquainted with, but never before did we know that the science of aviation had a little slang all, all its own. However, we were seated at our desk one day last week, when the door opened and a man walked in. We walked up to him and asked him what he wished. And then he started! As near as our troubled brain can remember the words, we reproduce them:

"Say feller, push on the foot-bar,—yer comin' to a turn: let out your gas, kid,—yer miles off'n the ground. Don't give me no oil, because I'm the best mechanic dat ever lived. Why, I'm the guy dat took the *buck* out of turnbuckle, and if dat ain't so, you can cut me loose from me parachute and let me drop:—der ye get dat?"

"But, my dear sir!" we exclaimed.

"Lay off dat 'Dear sir' stuff" he returned. "T'row in yer gyroscope, kid; yer wobbling all over the place! Bank yer turns, kid, yer skiddin', yer skiddin'! I came in here ter get a job, and I wants one,—see? If I ain't the goods I says I am, loosen me guy-wires and let me fall apart. I'm the original twin-six kid, and I know it! S'long!"

And he went out into the stillness of the night.

War Nates

Jess Willard has been accepted to drive a speed-scout after he takes his pilot's license. Aviation schools are busy reinforcing all machines.

No Zeppelin parties have been given by der Kaiser for quite some time. The English are quite worried over his lack of neighborliness.

When interviewed by our Russian correspondent, the former Czar intimated that he didn't care a whoop who won the war.

Six aeroplanes passed over Main Street, Hickville Center, last week, and an enterprising pickpocket got six watches in the excitement.

It is reported that a number of young men are organizing little flying parties in search of submarines, off the Atlantic coast. When submarines are seen, the young men plan to give them pleasant little surprises in the form of steel bombs. No doubt the submarine people will appreciate the harmless joke.

A great argument took place recently at the Oshkosh Aviation School about the correct way to loop-the-loop. One of the men described the sensation so vividly that eight men became dizzy and had to go outside for air.

Quite a Mechanic

Ethel: Yes, Charlie is a very good mechanic. Why, its wonderful how he can overhaul a motor! Just the other day he took his motor apart, and when he put it together again he had enough parts left over to make a motorcycle engine!

Our Own Dictionary

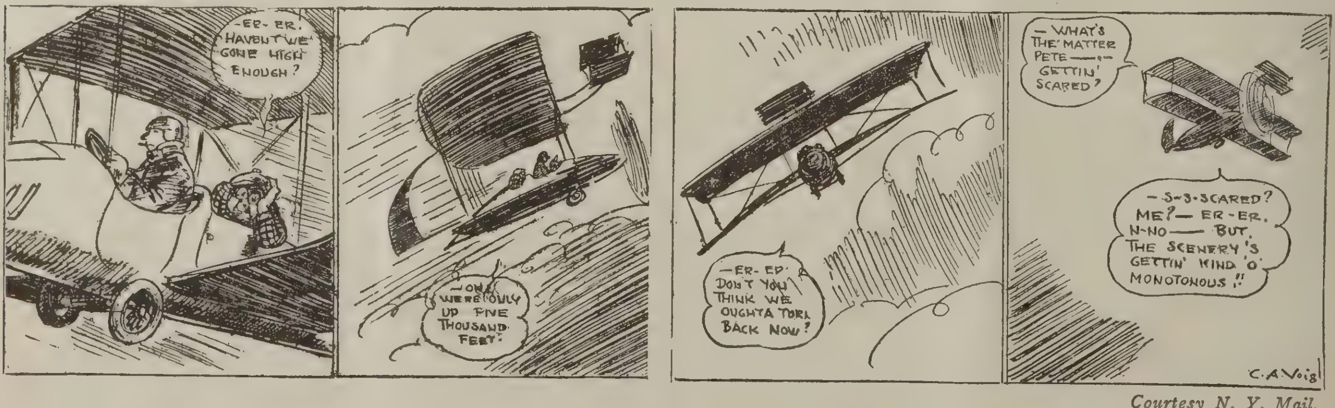
Spasm 3.

Brace—To ask for money.
Muffler—Worn by aviator in winter flying.
Strut Socket—A knee joint. (Very deep.)
Wing Stagger—Seen on Ornithopters.
Revolution Indicator—An uprising.
Water Jacket—Raincoat.
Shock Absorber—(Ask O'Sullivan—*he* knows.)

The Dying Aviator

Tune: "The Dying Lancer."

A handsome young airman lay dying,
(Chorus): *Lay dying,*
And as on the aer'drome he lay,
He lay,
To the mechanics who came round him sighing,
Came sighing,
These last dying words he did say:
He did say:
"Take the cylinder out of my kidneys,"
His kidneys,
"The connecting rod out of my brain,"
His brain,
"The cam box from under my backbone,"
His backbone,
"And assemble the engine again."
Again.

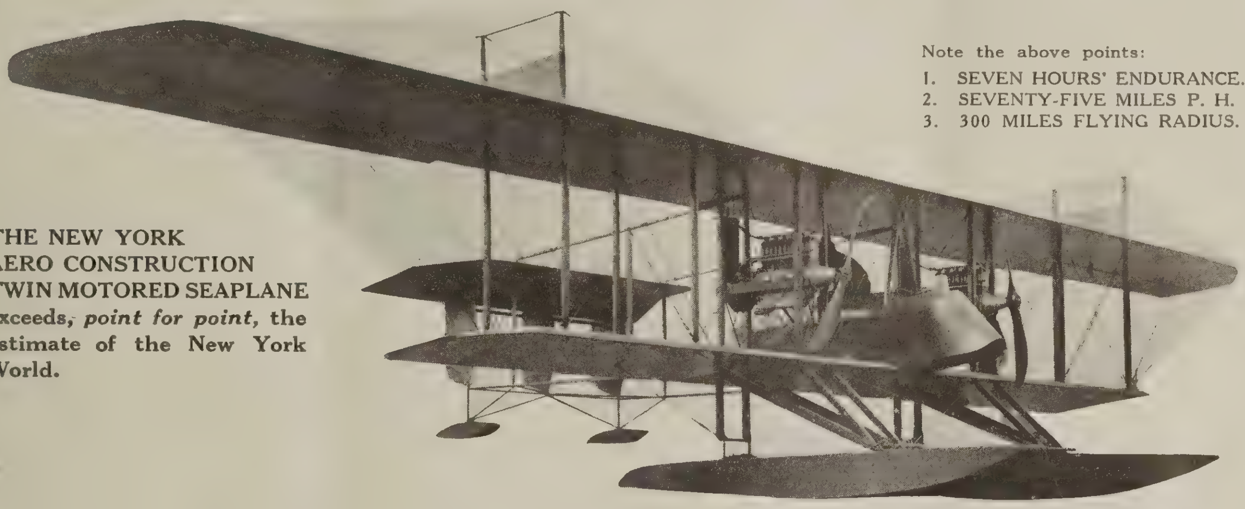

-ER-ER. HAVEN'T WE GONE HIGH ENOUGH?
-OH! WE'RE ONLY UP FIVE THOUSAND FEET!
-ER-ER DON'T YOU THINK WE OUGHTA TURN BACK NOW?
-WHAT'S THE MATTER PETE—GETTIN' SCARED?
-S-S-SCARED? ME?—ER-ER. N-NO—BUT, THE SCENERY'S GETTIN' KIND 'O' MONOTONOUS!!
C. A. Voig

Courtesy N. Y. Mail.

Urgent Need for Air Scouts

(Editorial in The New York World)

"Assuming seven hours' endurance, the air scout, at say seventy-five miles an hour, will be enabled to proceed out three hours, and return in three hours, leaving one hour for a safety margin. He ought to be able to locate an enemy fleet, or a convoy of transports, at a distance of 300 miles from the base from which he started."



Note the above points:

1. SEVEN HOURS' ENDURANCE.
2. SEVENTY-FIVE MILES P. H.
3. 300 MILES FLYING RADIUS.

THE NEW YORK AERO CONSTRUCTION TWIN MOTORED SEAPLANE exceeds, *point for point,* the estimate of the New York World.

PERFORMANCE

The New York Aero Construction Company's Twin Motored Seaplane has a maximum speed of 85 miles per hour, excelling the estimate by ten miles per hour. Yet it has a slow landing speed of 43 miles per hour, allowing the landings to be made within a much smaller space than is ordinarily the case. But what is even more important in coast defense work is the fact that it has a

FLYING RADIUS OF NINE HOURS

The advantages of a high speed and a wide flying range are obvious. The coasts of the United States are long, and the swifter the machines that guard them, and the longer they can stay in the air, so much better and more easily are the coasts patrolled. The seaplane mentioned in the editorial of the World, could, flying at full speed for its seven hours' flying radius, cover 515 miles. The seaplane of the New York Aero Construction Company could cover 680 miles.

820 Sq. Ft. Supporting Surface.
Two 100 H.P. Aeromarine Motors.
Weight 2,700 lbs. Useful load 1,700 lbs.

Maximum speed, 85 Miles per hour.
Minimum speed, 43 Miles per hour.
Flying radius, nine hours.

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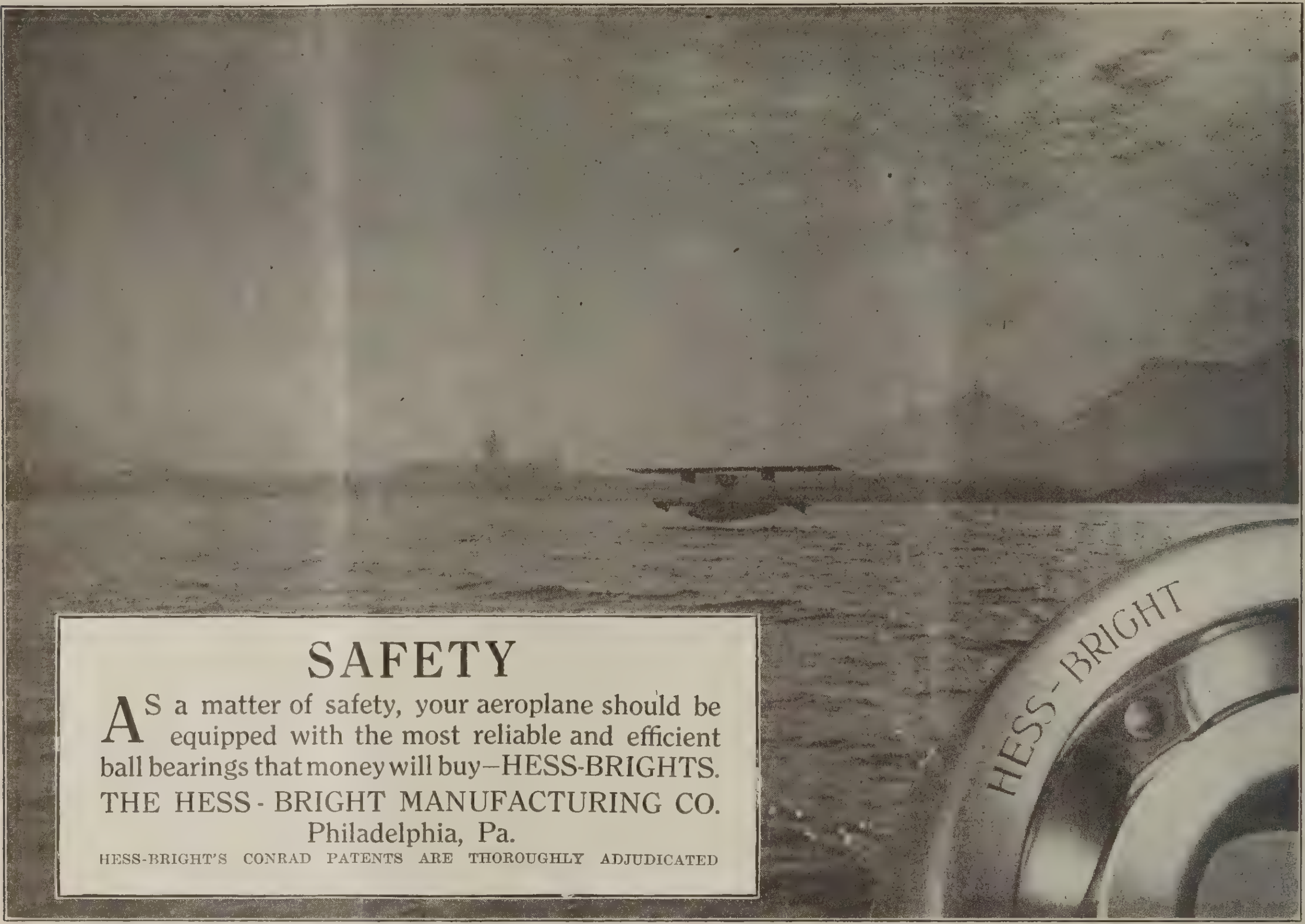

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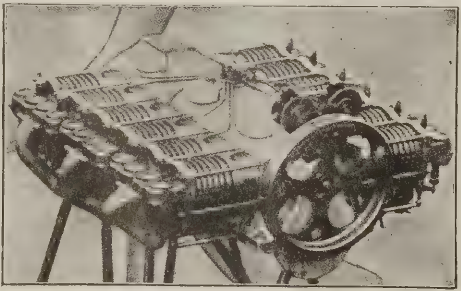

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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Carburetor—Improved ASHMUSEN.
Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
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A Pilot's Necessity

THE accompanying illustration shows the compactness and completeness of the Cooper Aeronautical Tool Box. With the assortment of tools shown the weight is only 44 lbs.—usually 60 lbs. are allowed for tools on Military machines.

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HALL-SCOTT MOTORS are offered to reputable aeroplane manufacturers as possessing those refinements in design and construction, together with consistent power delivery, under actual flying conditions, points of merit which are of absolute necessity to permit of meeting Government requirements in flying tests of the aeroplane.

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General Offices: Crocker Building, San Francisco
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F. P. WHITAKER 165 Broadway, New York City

(*Continued from page* 225)

corrected for instrumental errors by adding or subtracting the correction found by calibration tests over the cameras or speed course. This number is then again corrected for height by dividing by the square root of the density. The result should give the true air speed, subject, of course, to errors of observation. The numbers so obtained are plotted against the "standard" heights, *i. e.*, the average height in feet corresponding to the density during the test. A smooth curve is then drawn through the points and the air speeds at standard heights of 3,000, 6,500, 10,000, 13,000 and 16,500 read off the curve. These heights are chosen because they correspond closely with 1, 2, 3, etc., kilometres. The indicated engine revolutions are also plotted against the standard heights, because these observations form a check on the reliability of the results; also the ratio of speed to engine revolutions at different heights may give valuable information with regard to the propeller.

Table VI gives complete results of one of our tests of air speed at heights. The table refers to the same machine as Table V, which gives the results of calibration tests of the air speed indicator. Fig. 5 shows the smooth curve drawn from the calculated data, the actual air speeds calculated from the observations being shown by crosses, while the observed engine revolutions at the same heights are marked in by dots. Fig. 6 gives another example, where the observations were very good; the air speeds and r.p.m. lie very closely on a smooth curve except at one point (about 10,000 ft.), where they were probably affected by a downward current of air.

In a brief paper it is impossible to do more than explain the more important of the "performance" tests of aeroplanes, considered solely as flying machines. For military purposes a number of tests are necessary, some of which cannot easily be reduced to figures. Nor can it be supposed for an instant that the methods outlined here are final; aeroplane testing, like all other work connected with aeroplanes, is only in its infancy; and as time goes on, and knowledge accumulates, better methods and instruments will be evolved. There are some who lay considerable emphasis on the necessity of every test instrument being self-recording, and although this scheme appears at first sight Utopian and would relieve the pilot of a single-seater of considerable trouble, there are many objections to it when considered in detail, not the least of which is the difficulty of getting new and elaborate instruments made at a time when all manufacturers are fully engaged on other important work. When an observer can be taken I would personally place much more reliance on direct observations at the present time, and one great advantage of direct observation is that the results are *there*, and no time is lost through the failure of a recording instrument to record, a circumstance which is not unknown in practice. So far as we use recording instruments we use them only as a check on direct observations, although we shall probably soon adopt recording air speed indicators for the calibration tests. But whether recording or direct reading instruments are used, it is, as I said before, the flyer on whom the accuracy of the tests depends. I feel that too great stress cannot be laid on this; he is the man who does most of the experiments, and like all experimenters in every branch of science, he requires training and a great deal of practice. Although the methods themselves may be greatly changed, this much may perhaps be claimed, that the general principles on which they are founded are sound, and will only be altered in detail. The importance of the work can hardly be exaggerated; model experiments are notoriously subject to scale and other corrections, which if not carefully scrutinized may be very misleading, and it is only by accurate full scale work that we can hope to maintain a steady improvement in the efficiency of aeroplanes.

DISCUSSION

Captain Sharren, R.A.F., stated that in the main the same methods are employed by the R.A.F.

He used to think that a statoscope was unnecessary in speed tests as it was possible to fly level by aneroid, as he had found by experience that it was possible for a good pilot to fly for ten minutes at a time without the aneroid showing any change. He had, however, come to the conclusion that this might be due to lag in the aneroid.

They used a bubble statoscope now of a similar pattern but rather smaller, and therefore lighter, than that shown by the lecturer.

They also used the climb meter shown, but he was surprised to hear it called the "Raf" or "Navy" type, as he had never heard either expression before. At the R.A.F. it was usually known as the "copiometer," because it was copied from an adaptation of thermos flask, which he believed originated in Germany, where it had been used for some time in balloon ascents. It was not altogether reliable owing to the effect of acceleration on the column of liquid.

He considered it essential that men taught to carry out experimental flying should be selected from men who were accustomed to experimenting in other branches of science.

Captain Grinstead thought that it would be found necessary in the future to measure other qualities of the aeroplane than merely the air speed and rate of climb, to which tests were limited at present. He suggested that instruments would be required to measure the time it took an aeroplane to come on to a bank and the time taken to turn through a given number of degrees.

Major Filon considered that absolute accuracy was most important, and that this could only be obtained by standardizing methods in order that a true comparison of results could be obtained.

He thought that the results obtained should be circulated among manufacturers and designers, as a very small difference in the performance of two machines might lead to important developments in design, which emphasized the necessity for accuracy.

He enquired if the lecturer had experienced any difficulty owing to the lag in thermometers, as he had found that in some cases this was considerable. He considered it important that temperature should be measured directly instead of relying upon so-called "laws" which were unreliable and unsatisfactory.

He did not entirely agree with the lecturer in neglecting recording instruments, as these were undoubtedly capable of great improvement, and he thought it was expecting too much from a pilot that, in addition to flying the machine, he should have to read an aneroid, air-speed indicator, thermometer and revolution indicator.

Squadron Commander Busteed expressed the opinion that the work could be got through quicker without any instruments at all. A machine had to be got out as soon as suitable weather occurred, but if instruments were employed it was usually found that something was adrift and the opportunity was lost.

The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

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The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

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THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

WRIGHT-MARTIN AIRCRAFT CORPORATION

60 Broadway -:- New York

(*Continued from page* 195)

requirements and in a communication which we received the end of June, they stated that they had placed an order for six machines of that kind, and as soon as they had decided on the type of landing chassis which they wanted, they would have the changes made to conform with the other six machines. By October they had not yet settled on the type of landing chassis to be adopted.

"But at the time of the flight, we had occasion to talk to a prominent engineer, who had just returned from Europe, where he had seen all the European machines, and reported that the Curtiss twin-motored battleplane was a more efficient flyer in every way than the best European twin-motored machines. This battleplane, equipped with two motors of from 160 to 200 H. P. can, we believe, equal any performance of European machines of the same type. Half a dozen other manufacturers, including well established firms such as the Aeromarine Plane and Motor Company, the Burgess Company, the Gallaudet Aircraft Corporation, the Sturtevant Company, the Thomas-Morse Company, and other firms, have received orders from the Army and the Navy, and are now about to produce twin-motored hydroaeroplanes. With the experience they are gaining, we can expect that they will soon turn out efficient aeroplanes. This is also true of newer concerns, such as the New York Aero Construction Co., the A. S. Heinrich Corporation, the General Aeroplane Company, and others. So we may say that we have good prospects of getting twin-motored machines comparable with the best European machines of the same type. Of course, we must order and use machines, as perfection can only be obtained through evolution by actual use.

"(4) *The fast single passenger fighting machine:* The first demand for this machine in the United States came only a few months ago. Of late the Army and the Navy have both been planning to place orders for machines of this type, and half a dozen of the manufacturers have stated that they are ready to turn them out. The thing to be decided just now is whether the Army and Navy are willing to adopt the foreign specifications, and content themselves with fighting machines that have a factor of safety of two or three and carry two hours fuel and land at a speed of close to 85 miles an hour. If they will content themselves with this, we feel certain that American manufacturers can turn out fighting aeroplanes that will make a speed of close to 140 miles an hour, the best actual performances obtaining abroad with machines of good flying qualities and fast climbing speeds.

"But this low factor of safety and extreme landing speed, while necessary when it actually comes to fighting enemy aviators, can be dispensed with, at the cost of only about five to ten miles per hour speed, so long as our aviators do not have to fight enemy aviators, and thereby save considerable breakage of men and machines. Our committee came to the conclusion after watching the succession of breakages of the fast British fighting machines which has been tested at Governor's Island during the past few weeks. This machine was so lightly constructed and landed at such great speed, that there was breakage at practically every landing. Finally the two British officers who brought it over crated it away. The account of the death of Norman Prince, of the Lafayette Corps, tells that the machine he was flying landed at a speed of close to 100 miles an hour. The new Spad is almost as bad in so far as the factor of safety and landing speed are concerned. They are machines to use in battle, and American aviators will use them when they get there, but it would be wrong to say that they are better than the American fighting machines being turned out."

In rendering this report to the Commander of the Third Naval District, and in subsequent making it public, the Committee on Aeronautics has done a constructive patriotic service, and their findings will do much to dispel the feeling that has been caused by the misrepresentative statements of ill-informed persons who have unthinkingly, and not realizing they might hurt the aeronautic industry, have stated that our types did not compare favorably with European machines.

American constructors are ready and able to construct machines in large quantities as good, if not better, than any being constructed in Europe, and all that it is necessary to do to prove this is to have the authorities place orders which will call for continued, steady deliveries, for the next three years, so that our constructors will produce the good machine needed to train and equip the thousands of aviators whom we should send to co-operate with our allies in Europe, and thereby render the utmost service in helping win the war.

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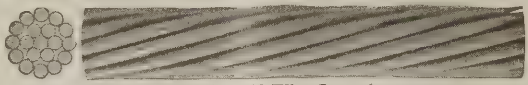

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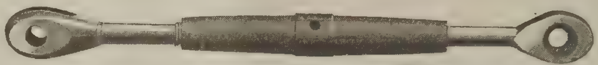

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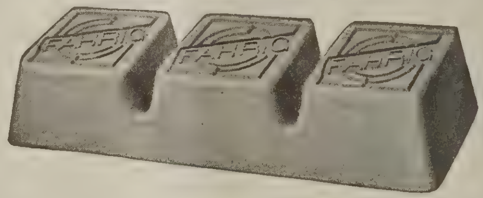

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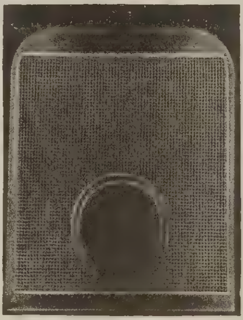

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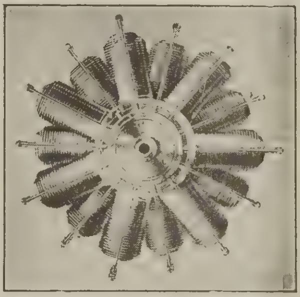

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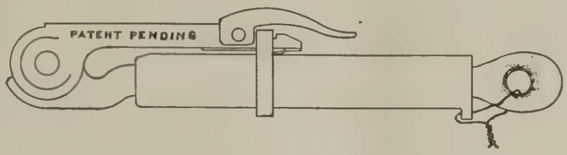

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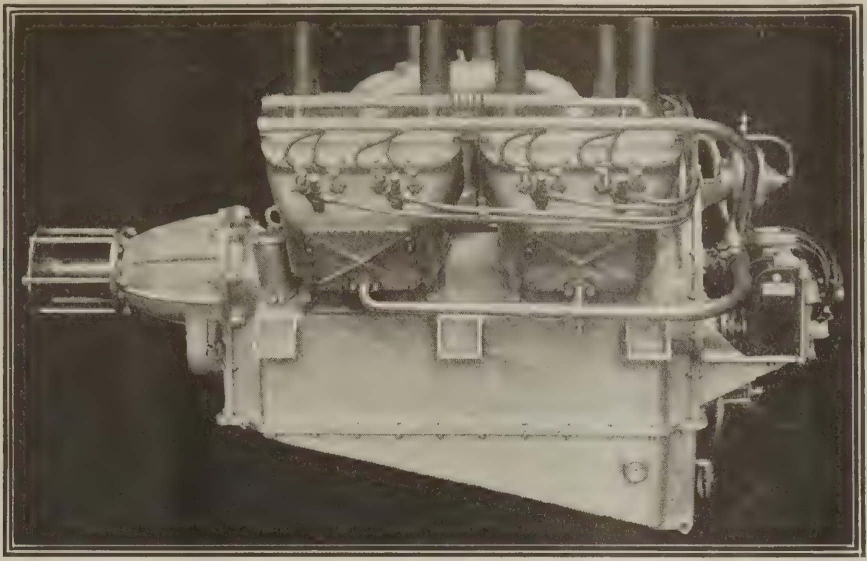

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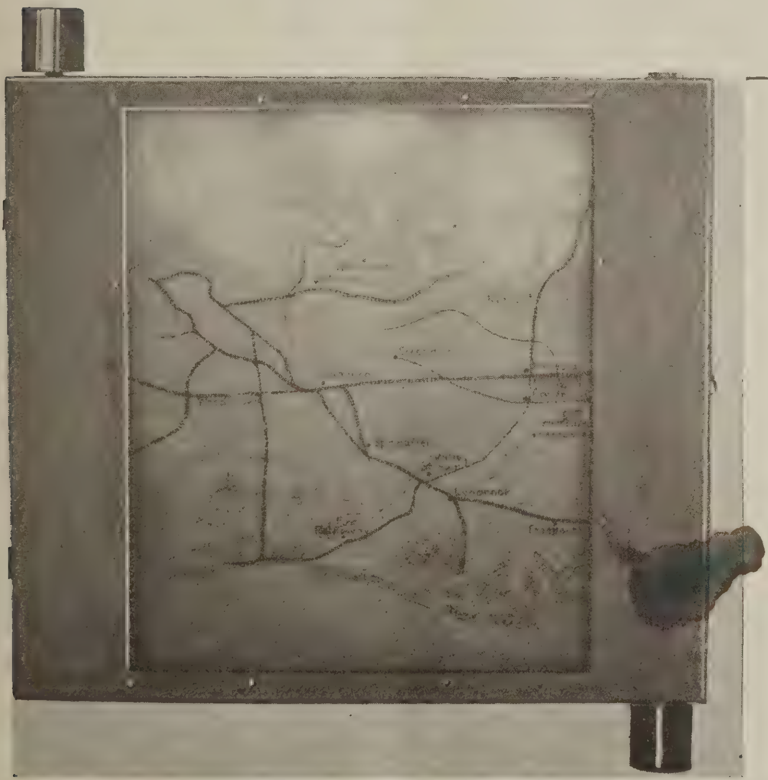

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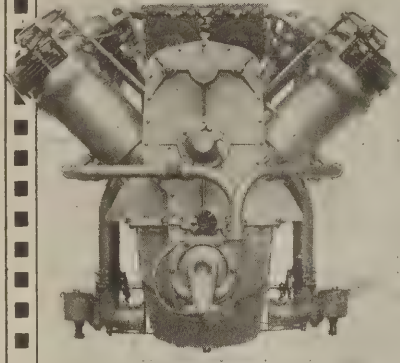

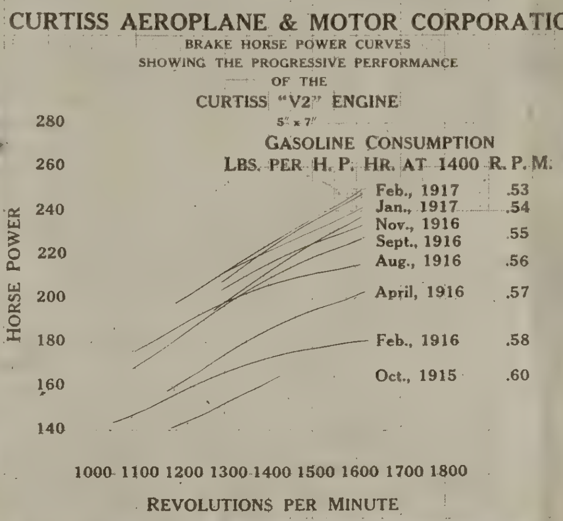

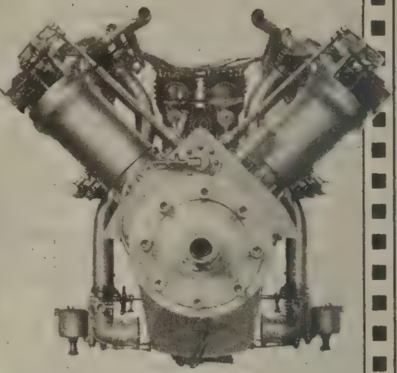

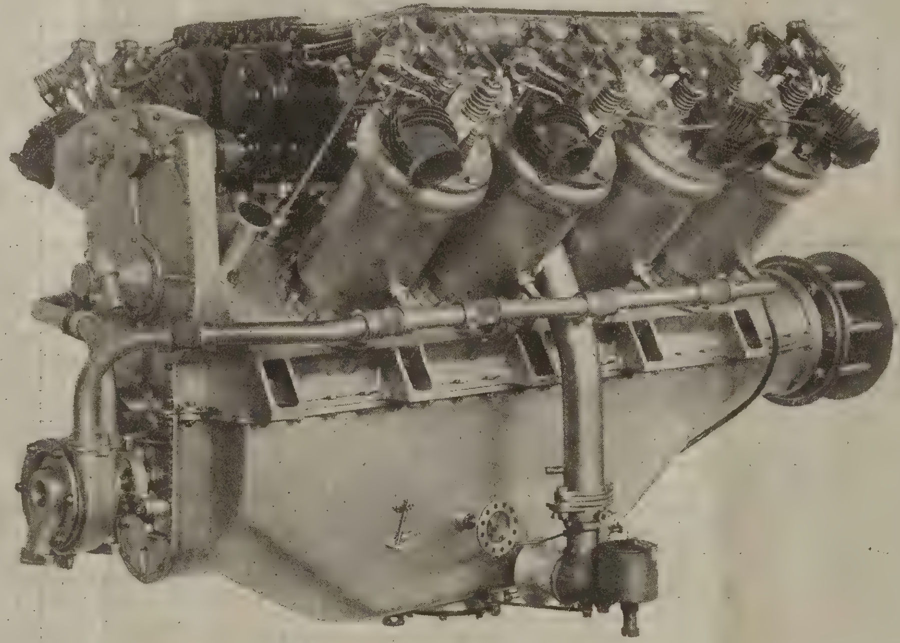

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Congress Asked to Adopt Plan to Send 5000 Aviators to Fight with Allies

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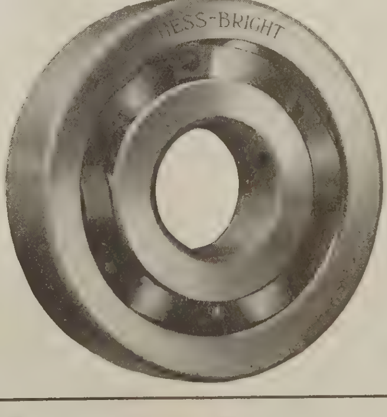

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*Transcript from the hearing before the U. S.
Senate Military Committee, January 31st, 1917.*
From Army and Navy Register

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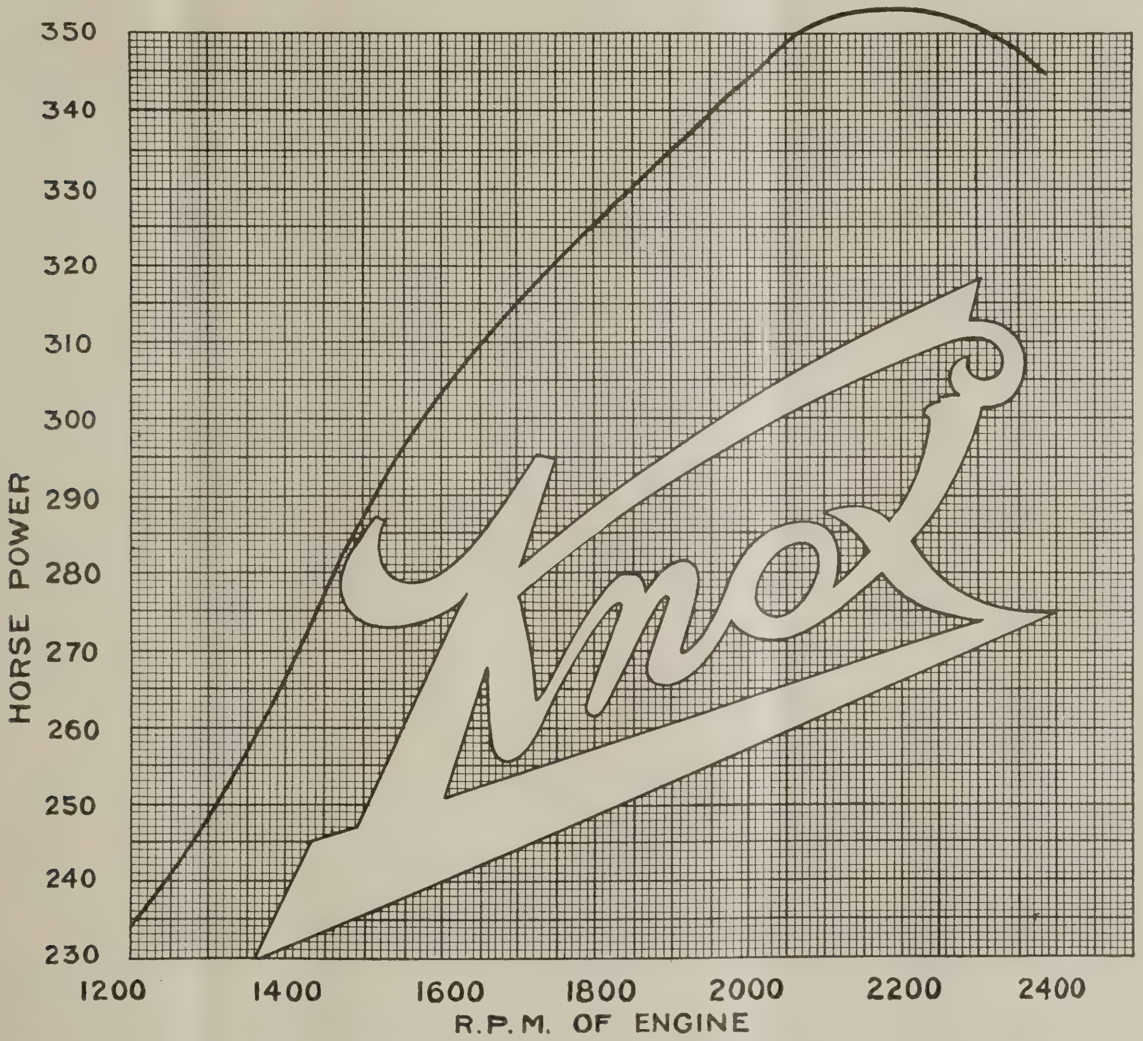

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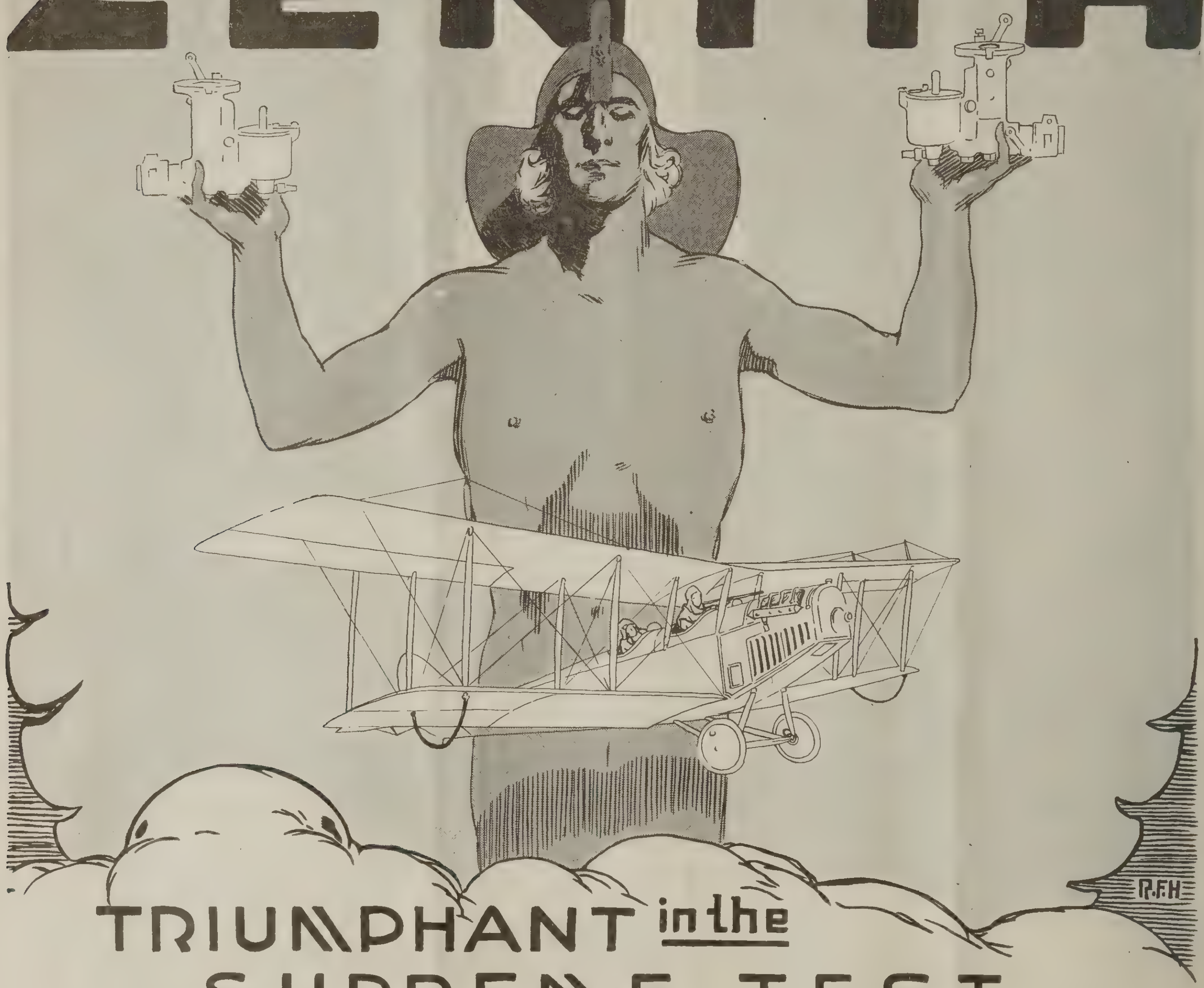

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VOL. V NEW YORK, MAY 7, 1917 No. 8

SELECTIVE DRAFT SYSTEM ADOPTED IN BOTH HOUSES BY OVERWHELMING VOTE

APRIL 28th will go down in American history as the day when the most helpful step towards insuring the peace and welfare of the Republic was taken. The selective draft system was adopted by both Houses by overwhelming vote. While the details have not been settled, the principle has been adopted. Senator Chamberlain and Congressman Kahn, the two men who did so much to put through the large appropriation for aeronautics last year were the sponsors for these important measures.

The Aero Club of America and *Flying* and *Aerial Age* played an important part in bringing this about, not only through their efforts which began three years ago, but through their very recent energetic efforts, the details of which have not been published, which resulted in hundreds of thousands of signatures being sent to Congress demanding the adoption of Universal Training.

SENDING 5000 AMERICAN AVIATORS TO FRANCE PROPOSED IN CONGRESS AND IS FAVORED BY BRITISH AND FRENCH AUTHORITIES

THE plan to send 5000 American aviators to France, as America's first step towards participating with the Alleis in the fight for Civilization and Humanity has met with general enthusiasm.

The plan received its approval simultaneously in Great Britain, France and United States. General Joffre himself asked for American aviators in his very first request.

In Congress the project was brought up by Congressman Murray Hulbert and in the Senate it was discussed by Senator Wadsworth.

"America Should Lose no Time in Getting Aeroplanes Under Way and Men Under Training," Say Allied Aeronautic Authorities

BRITISH HEADQUARTERS IN FRANCE, April 28, (via London.)—Wholly informal but decidedly interesting conversations between British and French flying corps officers as regards the possibility of early American participation in this fascinating phase of the war have been going on behind the lines here. It is generally agreed that apart from naval activity the flying service offers the quickest opportunity for effective military help from America against the common foe, and the expectation is that just as the aviation branch of the service proved so attractive to the young men of both England and France the youth of America will be drawn toward it.

Already plans are making to increase the number of Americans now flying for France, while all the members of the British Royal Flying Corps are ready to welcome and aid in the training of Americans in all the arts of war flying. It is realized that the United States Army is not on a war basis regarding machines, but it is understood that both the British and French services are prepared to furnish them temporarily, just as these two services now exchange machines as necessity demands.

America, of course, is expected to throw her organizing and manufacturing ability into supplying their own machines to her fliers, but the modern aeroplane with its tremendous power housed in a very compact, very light engine, with delicate instruments, unerring balance, and sensitive controls, is an extremely complicated affair and its construction is a matter of months.

Just now the single-seat fighting scout is the machine of the hour. Such machines must stand the terrific strain of fighting tactics—rolling, looping, nose-diving, side-stepping. It is no unusual thing nowadays to see a pilot seemingly fall out of control 2,000 feet or more, and then flattening out and sailing serenely away. The strain of this manoeuvre is tremendous.

The Associated Press correspondent has talked with many British flying officers of distinction and all agreed that the only way to train men for war flying is in actual fighting. They frankly say that in this way many men may be lost, but that those who survive are worth their weight in gold and prove brilliant flight and squadron leaders.

Officers of the British flying corps say that America must be prepared to pay such a price; that she must remember this when the losses begin to mount up. She must understand, they point out, that out of these losses will come men who will reflect glory upon her colors and lend brilliance to the brighter pages of her history.

It is, of course, possible to train men far from the battle field. They may become proficient in every trick of flying known to the science in this training. Their real service, however, only begins after they have proved themselves "over the line." The British have developed brilliant fliers at their training grounds in England, men who have mastered every technical point of aviation leaders. But each one of them upon reaching France must be attached to a squadron as an ordinary fighter and win his way upward through the soul-seaching shock of actual battle. Some of these men succumb, but the survivors more than repay the cost.

America, it is said, can render a great service to the Allies by sending over pilots at the earliest possible moment. They can join the British corps at once, and as they prove themselves can be reclaimed by America for organizing and training her squadron as these become available.

The care and maintenance of aeroplanes requires the constant attention of skilled men. If America would render an immediate service, according to the view here, she might send over 5,000 fitters, riggers, and mechanicians to take up this branch of the service now and learn every phase of the work of grooming and handling the delicate machines.

The air service does not stand still. Almost each day brings changes. It is the feeling here that America should lose no time in getting machines under way and men in training. The Allies hold the hard-fought mastery of the air, but they must be in a position always absolutely to overwhelm the enemy and keep him on the ground. The youth of America and Britain, it is thought behind the lines here, should, with their common ideals, common language, common love of sport, and common courage, skill, and daring, find ideal companionship in this hazardous but romantic war in the air.

Gustave Hervé Appeals for Aviators

Paris, April 26—Gustave Hervé makes an appeal in his paper *La Victoire* to the United States to send an army to France at the earliest moment possible. He says he is sure an ingenious people like the Americans will be able to raise and equip an army of 100,000 men within three months, as well as sending enough aeroplanes to prevent Germany keeping a single aeroplane or observation balloon in the air and to keep the heavy Krupp artillery blind by the Allied supremacy of the air.

CONGRESS ASKED TO ADOPT PLAN TO SEND 5,000 AVIATORS TO FIGHT WITH ALLIES

IN a stirring address delivered on the floor of the House of Representatives, Congressman Murray Hulbert proposed the sending of 5,000 aviators to fight with the Allies, and told how they can be had and trained. Following is his address, quoted from the Congressional Record for April 27:

Our honored guest, Right Hon. Alfred J. Balfour, some time ago stated on the floor of the House of Commons:

"The time is here when the command of the sea will be of no value to Great Britain without corresponding command of the air."

A great military figure, the late Lord Kitchener, stated that a well-trained and equipped aviator was worth a whole army corps.

And Marshall Joffre idolized upon his arrival in the Capitol City last Wednesday with no less enthusiasm than he was received at the gates of Paris upon his return from the Marne, after he had stemmed and turned the tide against the destruction of civilization, declared on the deck of the Mayflower as he passed historic Fortress Monroe:

"The French idea of an American participation calls for a fighting force supported by auxiliary services and a strong aviation section."

American Aviators In France's Great Work

We hear expressions of opinion daily that the present war will be decided in the air, and we know that the recent allied victories have been due to the fact that the allies have proven themselves to be the masters in aerial navigation; yet every cable dispatch of aerial accomplishment fills us with a thrill of pride because some valiant and brave American has been a participant. Only a handful they have been, but they have proven the statement that an aviator is worth a whole army corps. Today we are to decide what our first contribution to the common cause is to be. We are to select the most powerful, the most effective weapon with which to strengthen the hands of our Allies. It is conceded that it will require from nine months to a year to train and put a substantial American force in the field, but there is no doubt whatever that we could train and equip and send to Europe 5,000 aviators within a much less period; moreover, while many of you have expressed your doubt with reference to securing a sufficient number of volunteer soldiers, and others question the propriety of invoking the selective draft, it is a conceded fact that there are thousands of young men waiting to enlist in the air service, inspired by the novelty and fascination of aerial activity, so that we have no fear of the success of the volunteer service and no need of conscription so far as the air service is concerned. They are men of the best type, men like those brave and daring American aviators, William Thaw, Norman Prince, Elliot Cowdin, J. R. McConnell, C. C. Johnson, Lawrence Rumsey, R. Luffberry, Kiffin Rockwell, Bert Hall, Didier Masson and other members of the Lafayette Corps, who fought side by side with the French and British aviators for the past two years; **therefore I want to urge this House today to go on record in favor of a plan to make our first contribution to the common cause 5,000 well trained and equipped aviators.**

Our allies appreciate the fact that we can best help them by sending aviators, and they have already suggested, in fact, that it be done.

The prominent naval strategist, Rear Admiral Bradley A. Fiske, in a recent communication to the Board of Governors of the Aero Club of America, as the representative aeronautic body in this country, suggested that the club point out the advisability of sending to Europe a large unit of aeroplanes with well trained aviators and appropriate armament; and in response to an inquiry cabled by the French and British newspapers to the Aero Club of America, Mr. Alan R. Hawley, its president, replied:

"We have thousands of applications for aviation training from college men who are anxious to join the Army and Navy reserve or would like to join the American aero squadron in France or the Royal Air Service. Large aviation camps could and will undoubtedly be established immediately where students will be given their preliminary training in aviation and in military matters in general. The Aero Club has received a large number of offers of extensive tracts of land to be used free of charge as aviation training camps, and it has also received liberal offers of funds from patriotic citizens for training aviators in large numbers. But I believe that to give the best results and avoid confusion the training of 5,000 aviators to be sent to Europe should be undertaken by the United States Government. The suggestion comes at the most opportune moment, and you may rest well assured that there will be no lack of co-operation in the United States to make the plan effective. In the light of the situation here one is safe in predicting that of all of the forces to be dispatched from this side to the European battlefield the strong probability is that amongst the first will be a large number of representative aerial squadrons, consisting of the very best material that America can furnish, all fired by patriotic enthusiasm at the prospect of flying under the 'Stars and Stripes.'

A year ago, when Villa's raid brought out the fact that we had only 12 aviators and 6 aeroplanes available in the Army air service to meet the emergency, an appeal was made for aviators and aeroplanes by the Aero Club of America, which very patriotically undertook to train and equip aviators for the national defense and build up this very important branch of the Army and Navy.

Thousands Want to Join Air Service

The response to the Aero Club's appeal was amazing. Applications came from all over the country by telegraph, mail, telephone, and personal calls of the applicants. The energetic officials of the Club, who, by the way, have been the patriotic, far-seeing men who started and supported with all their might and to the fullest extent of their means the movement to build up our national defenses, arranged for the training of over 100 aviators, some of whom have actually become Army aviators, and others are to be found in the Aerial Reserve Corps, the Naval Reserve Flying Corps and in the aviation sections of the militia throughout the country.

But the response to the appeal brought such a flood of applications that it became imperatively necessary for the Government to take up and deal with it promptly and substantially. I had the pleasure of being a member of the committee which called on President Wilson on June 29, 1916, to bring to his attention the fact that there were 2,000 patriotic young men who had been waiting patiently—and impatiently—for a chance to enlist in the air service. When you consider that at that time one of our greatest national problems was, as it still is to a great extent, the problem of getting men to enlist in the Army and Navy, you realize why the Aero Club of America, of which I am proud to be a member, realized the importance of bringing the matter to the attention of the President of the United States, who, realizing its importance, immediately authorized the creation of the Aerial Reserve Corps, as provided for in the national defense act of June 3, 1916.

The Aerial Reserve Corps, which is part of the Officers' Reserve Corps, was authorized on July 13, 1916, and a few days later when, with the committee of the Aero Club of America, I called on Secretary Baker and at the offices of the aviation section of the Signal Corps, we were advised that the plan of the department was to immediately select 297 men to be trained as officers and aviators in the Aerial Reserve Corps, and to send them to some 10 private aviation schools, which were in a position to arrange for their training. Unfortunately this plan was not accomplished through the summer and fall, and the winter conditions were considered too difficult for student aviators to face, so the establishing of aviation training camps and the training of hundreds of aviators for the Aerial Reserve Corps was postponed.

Lack of Facilities Prevents Training of Aviators

Several aviation training schools are being established by the Army and the Navy, and while the plans are being made, I want to emphasize a condition existing which, if taken advantage of, will cause the thousands of aviators whom we should have as soon as possible, not only for national defense but also to send to Europe as our first contribution to help our allies to wage this fight for humanity and civilization. I know of many Members of Congress who have received applications from young men desirous of joining the Aerial Reserve Corps, the Naval Reserve Flying Corps, and who on applying to the War and Navy Departments have received the same answer that I have received, and thousands of young men have received, to the effect that the Army and the Navy are not in a position to take care of these thousands of patriotic young men who want to give their service for the upbuilding of our aerial service. The departments advise that the aviation schools are filled to the limit of their capacity, which is roughly estimated at less than 300 aviators, being trained, including the Navy Aviation School at Pensacola, the Army schools at San Diego, Cal.; Mineola, N. Y.; Memphis, Tenn., and the two new temporary aviation schools established at Chicago, Ill., and Essington, Pa., and the private schools being conducted for the Army at Miami, Fla. and Newport News, Va.

20,000 Applicants for Air Service

I am advised that the War and Navy Departments and their recruiting offices have been flooded with applications from men who want to join the air service, and that to put the estimates of those who have applied for training in the past few months at 20,000 would be conservative. The Aero Club of America alone has received about 4,000 applications in the past three months, including hundreds of applications from college men, some of whom have already been partially trained at private expense.

Patriotic Volunteers Doing Pioneer Work In Aerial Preparedness

In some cases young men, after waiting for months for action, undertake to pay for their own training, and there are today about 200 young men learning to fly to prepare themselves at private expense to be ready for the Army, Navy, or Reserve air service. A group of patriotic men, headed by Mr. H. P. Davison and Mr. Lewis S. Thompson, and with the co-operation of Messrs. Alan R. Hawley, Rear Admiral Robert E. Peary, John Hays Hammond, Jr., and Henry Woodhouse, are establishing a school to train 100 young men in aviation. Last year they founded Aerial Coast Patrol Unit No. 1, which gained distinction in the Mosquito Fleet maneuvers last September, and has been doing pioneer work in naval aeronautics. When war with Germany appeared to be inevitable, these young men left Yale University, where they were studying, and 29 of them reported to the aviation school in Florida, where they have been undergoing intensive training in aviation. They will now return to New York in a few weeks, and 100 will train at one single large aviation school. Two other groups of 12 patriotic men have formed Aerial Coast Patrol Units Nos. 2 and 3, and are taking aviation training at their own expense. Recently some Columbia University men formed Aerial Coast Patrol Unit No. 4, and within a few days they had 200 applications from Columbia men, and they are now making efforts to raise sufficient funds to purchase aeroplanes for training.

On March 10 an official of the Aero Club of America, Mr. Henry Woodhouse, delivered two addresses—one to Princeton University men and one to the alumni of Georgia Institute of Technology, and recommended that they form aerial coast patrol units. Today, thanks to patriotic men who presented the aeroplanes, a unit is training at Princeton. The suggestion to form an aero unit at the Georgia Tech. resulted in some 350 Georgia Tech. men applying for training. The officials of the college presented the names of these men to the Chief Signal Officer several weeks ago and told him that the Georgia Tech. will be glad to give the grounds to establish an aviation school and to also establish a course in the theory and application of aeronautics in the institute. Another patriotic man, a member of the Aero Club of America, last summer established an aviation training camp at Governor's Island and paid tens of thousands of dollars for preparing men for the Aerial Reserve Corps.

Aviators Trained by Private Contributions Is All There Is for Aerial Defense of Third Naval District

Those men and the men trained at Mineola, also at the expense of citizens fired by patriotic impulse, are now all that we have for the aerial defense of the Third Naval District. Still another member of the Aero Club of America, Mr. W. Earl Dodge, has been supporting an aviation training camp for training men for the Aerial Reserve Corps and has spent over $100,000 to help the upbuilding of our defenses.

Mr. Emerson McMillin, another veteran worker for national preparedness connected with the Aero Club of America, gave $34,000 towards the training of those aviators who are now available for the aerial defenses of the Third Naval District. And a few days ago a group of patriotic ladies formed the Aerial Aid Society for the purpose of paying for the training of 12 men and forming a unit of the Aerial Coast Patrol. The ladies of the National Special Aid Society have also contributed from time to time during the past two years towards the training of aviators. In fact, there was contributed the sum of $59,000 to train, equip, and support the First Aero Company of the New York National Guard before the War Department contributed a cent toward their upkeep. I know this was also true in Massachusetts. Mr. T. Jefferson Collidge, of that State, contributed close to $10,000 for training militia aviators in Massachusetts and New York. Amounts were also raised in Rhode Island, California, Michigan, New Jersey and other States.

I could go on quoting case after case of demonstrations of practical patriotism, including offers of seaplanes and seaplane stations for use by the Army and the Navy, by Rodman Wanamaker, J. P. Knapp, August Belmont, Mrs. William H. Bliss, Mr. Floyd-Jones and others; and I also could give the names of those patriotic young men like F. Trubee Davison, Robert A. Lovett, G. G. Depew, Frank Goodyear, David Clinton Backus, J. F. Knapp, Charles B. Wrightsman, Duncan Forbes and others, who are not only paying for their own training but are also organizing units of the Aerial Coast Patrol.

It is not necessary for me to point out that the country at large appreciates the necessity of upbuilding our aerial defenses and the national demands that steps be taken immediately to train and equip at least 5,000 aviators. The action of the Sixty-fourth Congress in voting appropriations amounting to about $18,000,000 for the Army and the Navy for aeronautics proved that the country had just begun to appreciate the need of developing our aerial service.

I dare say that if a canvas were taken it would be found that the country demands that prompt action be taken in building up an air service equal to the air service of the first-class European countries.

Air Service is the Balance of Power

The air service today is the balance of power which decided the daily victories of the armies in the present war. Several weeks ago, before the present drives of the Allies started, there took place a succession of aerial engagements which lastd for several days, until the Allies were victors. Having mastered the enemy in the sky, it was easy to drive them from their intrenchments. Having supremacy in the air, the Allies could prevent the German aviators from following the movements of the Allies, whereas the Allied aviators had free access over the German lines.

Aircraft Needed to Protect Billions of Dollars' Worth of Shipping

We are going to ship billions of dollars' worth of supplies to the Allies, and we shall have to protect every dollar's worth of those supplies and every ship employed in transporting them from the attacks of submarines and from submerged mines. Nothing else is so well adapted for protecting our harbors and shipping lanes from submarines and mines as the seaplane, dirigibles and observation balloons, a fact which has been amply demonstrated in the present war. Great Britain has 107 aeronautic stations along her coasts. And yet the coasts of Great Britain total only about 1,500 miles. With thousands of miles of coast we should have at least as many stations as Great Britain has, extending from Maine to the State of Washington. The National Aerial Coast Patrol Commission, of which I have the honor to be one of the commissioners, has been pointing to this vital need for the past two years and urging action.

On April 13 I presented to this House the plan for the aerial defenses needed for the Third Naval District, a basic plan of aerial defenses suitable for the 13 continental and two insular naval districts, prepared by the Advisory Committee on Aeronautics which is co-operating with the commandant of the Third Naval District in the organization of the Naval Reserve Forces. This plan shows what must be done to establish an aerial coast patrol substantial enough to protect our shipping. I pointed out in that report that Sir Edward Carson, on February 21, 1917, reported to the British Government that since the commencement of the war the British Navy, with the co-operation of its most efficient aerial coast patrol, had examined 25,874 ships. During the first 18 days of February 6,076 ships arrived in ports of the United Kingdom, and 5,873 ships had cleared the ports convoyed by dirigibles or seaplanes. Sir Edward Carson is authority for the statement that from the beginning of the war up to October 30, 1916, the British Navy transported across the sea 8,000,000 troops, 9,420,000 tons of explosives and material, 47,504,000 gallons of gasoline, over a million of sick and wounded, and over a million mules and horses and so forth. It cost Great Britain approximately $350,000,000 to build her present air service, half of which was spent for the naval air service and aerial coast patrol.

What would the fate of the Allies have been if Great Britain had hesitated in investing large sums in a substantial air service?

And, now that the United States is about to undertake to ship billions of dollars' worth of supplies, we need a substantial air service and aerial coast patrol to protect our ships from U-boats and mines.

Our neighbor, Canada, sent 600 aviators to England since the beginning of the war, and is now spending $80,000,000 in aeronautics and in training and equipping 20 aero squadrons. The Allies know the valor and daring of the American aviators. **So the Allies hope for that kind of assistance and co-operation; they need thousands of them, and we should not lose time in trainng and equipping and sending them.**

Department of Aeronautics Needed to Relieve Overburdened Signal Corps and Bureau of Operations

To train these thousands of aviators to be sent to Europe and the thousands more needed for her national defense, to protect the billions of dollars' worth of shipping, will take an

(*Continued on page* 271)

THE NEWS OF THE WEEK

W. Earl Dodge Presents Hangars to Third Naval District

Mr. W. Earl Dodge, the New York millionaire, who has been conducting, at his own expense, an aviation camp for college men at Newport, R. I., and at Jacksonville, and recently offered his $200,000 yacht to the Government, has made another valuable contribution toward the upbuilding of the aerial defenses of the Third Naval District. He has offered to build three steel construction aeroplane hangars at any of the naval aviation stations Rear-Admiral Nathaniel R. Usher, the Commandant of the Third Naval District, may decide. The offer was made through Mr. Alan R. Hawley, the chairman of the Advisory Committee on Aeronautics co-operating with Admiral Usher in the organization of the Naval Reserve Forces, and Admiral Usher promptly accepted it, and the hangars will be set up at one of the seaplane stations being established on lands offered free of charge for use by the Aerial Coast Patrol and the Naval Militia Aviation Section.

Mr. Dodge's aviation school at Jacksonville, which is in charge of Mr. F. C. G. Eden, will soon graduate ten students, all college men, who will then apply for admission in the Aerial Reserves. Their training and maintenance have been paid for entirely by Mr. Dodge.

The Dodge school is to be moved to Long Island within a few weeks.

University of Illinois Wants Aviation School

Champaign, Ill.—President Edmund J. James, Mayor Swigert of Champaign and Mayor Browder of Urbana, have joined in a request to Major General Thomas H. Barry of Chicago, that he establish a navigation school near the University of Illinois. The county fair grounds, which cover fifty-five acres, are offered as a site. The university also offers the use of its armory, other buildings and the parade ground.

Work Being Rushed on Aeroplane Factory

New Orleans, La.—New Orleans will be placed on the map as a manufacturer of aeroplanes by the Richardson Aeroplane Corporation, Incorporated, which has started the construction of its factory on Orleans Canal and Lake Pontchartrain. The company is a local enterprise and is rushing its plant to completion in order to tender its output to the federal government and other governments of the entente allies which are begging for flying machines. It will be the first aeroplane factory in the South and is expected to attract great attention to this city.

St. Louis Opens Campaign for U. S. Aviation School

St. Louis, Mo.—Contributions are being received for a campaign inaugurated by the Missouri Aeronautical Society and other organizations interested in aviation for the purpose of raising a fund to lease grounds in the St. Louis district which are to be placed at the disposal of the United States army for an aviation field.

John G. Lonsdale, treasurer of the society, is receiving contributions, which range from $5 to $1,000. The men interested in bringing one of the aviation stations to St. Louis, are anxious to collect sufficient money to wire the department an offer of a site.

Albert Bond Lambert has sent a telegram to the War Department, in which he offered the department free the use of six licensed and experienced balloon pilots as instructors and the use of balloons and grounds. The labor and gas also will be supplied free, Lambert wired.

Deficiency Bill Carries Appropriation of $54,450,000 for Aviation

The Deficiency Bill under consideration by the House of Representatives at date of writing carries an appropriation of $54,450,000 for aeronautics.

Lieut. Vernon Castle Here

Lieutenant Vernon Castle of the Royal Flying Corps returned to this city last week after ten months' service on the British front, during which time he brought down two German flyers. He was discovered by Frank Tinney, the comedian of "The Century Girl," who, while poking fun at the director of the orchestra, suddenly saw Mr. and Mrs. Castle seated well in the front of the theater. Tinney had been discussing the airs he wanted the orchestra to play when he said: "Let us have some air appropriate for our distinguished visitor, Vernon Castle."

Mr. Castle could not say how long his furlough was to be, and refused to discuss details of his service with the Royal Flying Corps. He arrived in Canada on April 23, according to a report from Toronto, with other officers to assist in the training of new Canadian airmen.

Later the spot light man at the opening of the new "Midnight Frolic" on the New Amsterdam Roof singled out Mr. and Mrs. Castle from the throng of dancers, and the audience applauded, led by Ethel Barrymore.

Stalnaker to Form Aero Squadron

W. E. Stalnaker, vice-president and director of sales of the Pathfinder Company, has tendered his services to Harry B. Smith, adjutant-general, in recruiting an aero squadron of 168 officers and men. "I am already in touch with some high quality men throughout a number of states," wrote Mr. Stalnaker, "most of whom are members of the Society of Automobile Engineers, or the American Automobile Association, or both, and will make the very best material for an organization of this kind. I am ready to commence recruiting immediately on notification of your acceptance."

General Smith in his reply thanked Mr. Stalnaker for the offer and said: "At the present time we have no authority to organize an aero company, but request has been made of the department and we hope to be advised regarding it in a very few days. I will communicate with you just as soon as any definite information is received."

New Aeroplane Dope

The perfection of a liquid chemical composition or aeroplane "dope" which will make not only the wings, but the entire wood construction of an aeroplane absolutely fire-proof, thereby eliminating one of the greatest dangers in aviation, is announced in a letter written to the Board of Governors of the Aero Club of America by Mr. W. R. Weeks, president of Weeks & Company, of 95 Liberty Street, New York.

This solves a problem in war and peace. In war it means that incendiary bullets will fail to set an aeroplane on fire, as they do now, which means death to the aviator and observer, because the fire usually burns vital parts before the pilot can land the aeroplane. It also means the elimination of fires from different causes.

It is almost impossible to keep the various parts of the plane adjacent to the motor and propeller free from gasoline, and machine oil makes the danger of a disastrous blaze from the back-fire of the engine a constant menace.

Mr. Weeks in his letter to the Board of Governors of the Aero Club states:

"Oil and gasoline, spilled or splashed over the plane surfaces, when ignited by back-fire, will not burn the fabric if it has been treated with our dope—the fire cannot reach the fabric and will not spread beyond the extent of the oil-covered area. This will be a wonderful protection to the machine when on the ground, and will also be a decided element of protection against fire when the machine is flying even if hit by shrapnel fire.

"Should the gasoline tank explode in the air and blazing gasoline run out over the rudder, our dope would absolutely protect the rudder and control from burning, thus enabling the aviator to volplane to a landing.

"In addition to the dope for aeroplane fabric-covered surfaces, we have simultaneously perfected a real fire-proof paint for the protection of the wooden parts of aeroplanes. This paint in case of fire acts exactly like the metal covering on wooden doors. Intense heat may carbonize the wood but our fire-proof paint will keep the support intact.

"The utility of this invention is vital to present aeroplane construction where the element of eliminating all possible weight is so important. Heretofore it has been found necessary to use metal for the base and supports of the engine, and steel in various parts of the construction, to insure a degree of safety against destruction by fire where the nearby parts become oil-soaked.

"It can readily be seen that considerable weight can be saved here if wood can be so fire-proofed that it can be substituted for metal in many parts of the frame. We shall take pleasure in demonstrating the effectiveness of our fire-proof paint at the time the official test is held."

The officials of the club are very much impressed by this invention, the details of which will be considered at the meeting of the Board of Governors.

Hangars and one of the Curtiss machines of the Princeton Aviation Corps. Lieut. E. R. Kenneson is head instructor

Lanzius Aircraft Company

With the manufacturing facilities of three large up-to-date factories in New York, Tennessee and New Jersey, the Lanzius Aircraft Company, of New York, is now in a position to execute orders for the Lanzius changeable angle of incidence aeroplane, in any type, for land or sea, or for standard and special design aircraft, either wood or steel construction. The company furnishes with its standard equipment, Duesenberg motors, recognized as one of the most powerful and efficient aeronautical motors on the market.

Possibility of Aviation School in Kentucky

Lexington, Ky.—A short time ago two young men of this city requested the Lexington *Herald* to find out what possibilities there were for receiving training in aviation. The editors wired the Aero Club of America, and received the following response:

"We beg to reply to your telegram of the 11th. Flying schools are not too plentiful at this time and there are many applicants. Perhaps as near to you as any are the Benoist School at Sandusky, O., and the Williams School at Celina, O. The Curtiss Schools, which have high standings, are probably pretty well filled up with applicants.

"For a more complete list of schools we suggest that you write to FLYING Magazine, 280 Madison Avenue. They should have the latest information.

"If it were possible for you or your friends to interest a few patriotic people to buy a couple of planes from some manufacturer you could organize a unit of, say, twelve men to learn flying and probably the manufacturer would gladly arrange for flying instruction.

"If your friends simply wish to enter Government service and get flying training there under enlistment, we suggest application to Chief Signal Officer, U. S. A., Washington, D. C., for Army Reserve or to Bureau of Navigation, Navy Department, Washington, D. C., for Naval Flying Reserve.

"If we can give you further information or assistance please call upon us. Yours very truly,

AERO CLUB OF AMERICA."

The *Herald* has now opened a fund to which citizens of Lexington may subscribe to purchase one or more aeroplanes.

Bridgeport Aviators Called to Service

Bridgeport, Conn.—Activities which have prevailed at the state armory since the first call was issued to the local soldier boys, extended to the aviation corps when it received its official call from the war department for immediate mobilization. This order affects twenty-five men, for the most part new recruits, who have enlisted within the past few weeks. The men were ordered to report at the armory by Lieutenant A. C. Chippendale who has been in command since the departure of the naval militia.

Exactly where the corps is ordered to report cannot be published, except that the men will be sent to training quarters somewhere in the east. Some of the men have not yet received their equipment, but will be obliged to leave in civilian attire if it does not arrive before the hour of departure.

U. of P. Show for Aeroplane Funds

Pittsburgh, Pa.—Successes in the four large cities of the east, where they have given performances, presage for the Mask and Wig Club, scheduled to give a performance in the Schenley Theater, when a two-act musical comedy, "Mr. Rip Van Winkle," will be presented, a crowded audience of Penn alumni and their friends. The net proceeds of the display will be devoted toward the purchase of aeroplanes, field pieces and rifles for the several battalions of the University of Pennsylvania now in training under a Regular Army officer.

Retired Officers Recalled

The drain upon the officer-personnel of the Army caused by the war preparations now being made is strikingly illustrated by the recall to active service of Col. William A. Glassford, U. S. A., ten days after his retirement was ordered. Colonel Glassford has been detailed as departmental aeronautical officer of the Western Department. The Signal Corps Aviation School at San Diego, Cal., of which Colonel Glassford was head when he was retired on April 11, is at present under the command of Col. Alexander L. Dade, Cav., U. S. A.

New Searchlight Tested

Tests of a new and very powerful type of searchlight, designed for use in conjunction with anti-aircraft defenses, were made at the Mineola, N. Y., aviation field recently. Preliminary reports contain the statement that watchers were able to "pick up" an aeroplane two miles away and follow it without trouble. One of the searchlights in use was of 1,000,000 candle-power, with a lens sixty inches in diameter.

Prominent British Aviator Discusses Aeronautics

Maj. L. W. B. Rees, the aviator who accompanies the British war commission, thinks it entirely probable that after the war aeroplanes will cross the ocean and be used in a commercial way. The British airman has been in many battles in the air and has watched the development of the aeroplane in the war. The English machines, in his opinion, are a trifle superior to those of the other nations, though France, he said, is running neck and neck with the British. Maj. Rees would not comment upon American machines.

"It is marvelous what wonderful development has been made in the aeroplane since the war began," said Maj. Rees, at the Shoreham. "In the two years and eight months that the struggle has lasted the speed maximum of aeroplanes has increased almost beyond belief. A year ago it had attained 118 miles an hour; today it is in the neighborhood of 125, and I am told since coming to America that a new Vickers machine in this country has been built to make 137 miles. Really, it's hard to believe, isn't it?

"Yes, I think it quite probable that aeroplanes will be crossing the ocean after the war, when they will be put to other work than war. In this country, I believe, you had a machine all ready for crossing, and I have no doubt it would have been successful. Just recently a French aviator in the ordinary army type of machine made a sustained flight of more than seven hours. It is only a question of the number of tanks to be carried."

Maj. Rees is retiring and modest. He walks with a limp, the result of a bullet in the knee received in an air battle for which he won the Victoria Cross. The major would not recite the story of that fight, but said merely that it didn't worry him much. Maj. Rees paid Immelman, the German aviator, who was killed more than a year ago, a high compliment, saying that the Britishers had a great regard for him because he played the game fairly.

Pennsylvania Aero Club Studies Navigation

Philadelphia, Pa.—To best serve the country and aid in bringing about a successful culmination of the war, many members of the Aero Club of Pennsylvania will study navigation. A class was formed after Henry A. Wise Wood, vice-president of the Aero Club of America, told them that the science would be of great practical benefit to them if they joined the aviation service and that those unsuccessful in entering that branch of the service would find it invaluable if they joined the navy. Many other members of the club will accept positions in aviation schools and aeroplane factories to get a practical working knowledge of aeronautics.

The navigation school will meet twice a week in the office of Joseph A. Steinmetz, president of the club, in the Morris Building. The school will be conducted at the expense of President Steinmetz.

An expert navigator will be engaged to teach the scholars the rudiments of navigation. In twenty lessons, it is thought, those who attend will get a fair theoretical knowledge of the science which can be best supplemented by enlisting in the aviation corps or in the navy.

"By learning navigation," Vice-President Wise Wood said, "you will be doing something of great practical benefit to the country."

New Wisconsin Test Room

The Wisconsin Motor Manufacturing Company has recently added a new test room which is entirely electrically equipped.

Each test stand has an individual electric motor generator unit. When an engine is completed in the assembly department, it is sent to the test room and connected up with the motor generator which acts as a motor and drives the engine until it is sufficiently free to allow it to be run under its own power. A uniform product is assured as each instrument board is equipped with meters which give the actual power required to drive the engine.

When the engines are sufficiently free they are started and run under their own power, driving the motor generator as a generator. The load is then gradually increased until motor develops the required power and then it run under full load for several hours.

The engine is then picked up with an electric crane, of the monorail type, and taken to the final inspecting department, where the motor is completely dis-assembled and all moving parts are given a thorough inspection and adjustment, after which motor is again placed on the test stand and run again for several hours. It is then ready to be shipped.

The large number of special motors built, made it necessary to have a test stand which can easily be adjusted to any width of supporting arms and to any drop or rise. The motors are connected to the generator with an ingeniously designed coupling, which is readily assembled in a few minutes.

All the current that is generated by the generators during tests is reverted into the factory line and used to drive the machinery, giving the benefit of power which otherwise would have been wasted.

Each motor has an individual exhaust pipe leading to the outside of the building. These pipes are underground. A connection is arranged at each test stand for water, gas and gasoline. The motors are run on illuminating gas unless a fuel economy test or carburetor test is desired.

A new experimental laboratory has just been completed. This is equipped with a thrre hundred horsepower Sprague dynamometer so arraigned that a motor can be mounted on either end and driven in either direction. Complete equipment has been added for making horsepower and torque curves, fuel economy curves, oil consumption curves, friction horsepower curves, etc.

This laboratory will be used for experimental work in connection with the improvements of the product.

The new test room of the Wisconsin Motor Co., with a batch of aviation engines on test

Japanese Owners of the Standard Aero Corporation Sued by John E. Sloane

The Japanese owners of the Standard Aero Corporation, of which Harry Bowers Mingle is president, have been sued by Mr. John E. Sloane. The details of the suit are given in the New York *Times* for May 1st, as follows:

"A suit of John Eyre Sloane, an inventor of aeroplanes, who married Miss Madeleine Edison, daughter of Thomas A. Edison, against the Mitsui Company, a Japanese commission firm, for an injunction and an accounting, was revealed in the Supreme Court yesterday, when Konosuke Seko of 150 West Seventy-ninth Street, general manager of the Mitsui Company, was examined in Sloane's behalf.

"Sloane also names as defendants the Sloane Manufacturing Company and Shunzo Takaki, assistant manager of the Mitsui Company. The Sloane company is a New Jersey corporation which manufactures airplanes at Plainfield, and has 50,000 shares of stock valued at $10 each. Sloane held 26,500 shares of the stock. He alleges that he agreed to borrow $30,000 from the Mitsui Company through Takaki to finance the manufacture of airplanes for the Russian Government, giving his stock as security, and that it was agreed his shares were to be returned as soon as the loan from the Mitsui Company had been repaid from the profits. Without his authority, and in violation of the agreement, he also alleges, Takaki in May, 1916, transferred his stock to the Standard Aero Corporation in which the defendants are interested.

"Sloane charges that after his majority stock in the company had been transferred the defendants "stripped the Sloane Manufacturing Company of its assets and highly profitable business," and the Standard Aero Company took over the business. He wants the defendants enjoined from carrying out their purposes and demands that they account.

"Seko, manager of the Mitsui Company, examined by Milton Mayer for the plaintiff, testified that his company had some dealings with Thomas A. Edison, as the result of which the loan to Mr. Edison's son-in-law was made. Sloane found himself unable to get the financial aid he expected from his relatives, Seko said, and finally adjusted the matter by turning over the stock in payment."

Rapid Work at Princeton

The Aviation Corps recently founded at Princeton University is a model after which other colleges well may follow.

Under the leadership of Mr. James Barnes of the class of 1884, funds amounting to $200,000 were collected from Princeton Alumni, and the Corps was incorporated. The activity that followed is worthy of commendation, both for its efficiency and its speed.

On Saturday, the 14th of April, a contract was let out to the Matthews Construction Company of Princeton, New Jersey, for three hangars, to be constructed of wood. Construction was started the next day, and two hangars were ready for the machines the following Friday, the day the first machine arrived. Flying was started two days after the first machine arrived. The Matthews Company built the hangars at cost. Two hundred students have volunteered to take the complete course, which includes radio work, semaphore and wig-wag signaling, telo-photography, and machine gun practise. In addition to the machine already at the field, three others have been ordered, and one is expected this week. Later on the authorities hope to have ten training machines, a twin-motored tractor, and one or two scout machines. All the aeroplanes used are Curtiss JN4B's.

Further funds are needed to carry on the work and Princeton Alumni who are interested may send subscriptions to Mr. James Barnes at the Nassau Club, Princeton, New Jersey.

W. E. Stalnaker, vice-president of the Pathfinder Company, who is organizing an aero squadron

Aviation Field at Westport

Hartford, Conn.—At the April 13th session of the Connecticut Assembly the committee gave approval to the recommendation of the state park commission for $1,500,000 for acquisition of land for state reservations which will include the big aviation field at Westport, and an additional $15,000 for surveys.

Army and Navy Orders

S. O. 93, April 23, War Dept.

Sergt. Clyde B. Hamlin, S. C., 1st Aero Squadron, Columbus, N. M., to San Diego, Cal., for duty at Aviation School.

To be 1st Lieuts., Sig. (Avia. Sec.), O. R. C., from April 2, 1917: Rolph, William T., 21, Oct. 21, 1895, Newport News, Va. Culver, Howard P., Feb. 22, 1893, Newport News, Va.

To be 1st Lieuts., Sig. (Avia. Sec.), O. R. C., from April 4, 1917: Barneby, Walter V., 23, Dec. 6, 1888, Newport News, Va. Kenneson, Edward R., 24, Nov. 4, 1894, Newport News, Va.

Col. William G. Haan, C. A. C., and Capt. Shepler W. FitzGerald, junior military aviator, Signal Corps, are relieved from duty as members of a joint Army and Navy Board for the selection of sites for joint aeronautical stations on the Atlantic coast.

Capt. Follett Bradley, 1st Field Art., O. D., to Fort Slocum, N. Y., with a view to examination for physical qualification for detail to aviation section, Signal Corps.

First Lieut. Seth Low and Cord Meyer, aviation section, Signal Officers' Reserve Corps, to active duty, office of Chief Signal Officer.

Capt. Wiley E. Dawson, retired, at his own request, from duty at the Signal Corps Aviation School, San Diego, Cal., to home. (April 19, War D.)

Signal Corps

Lieut. Col. Edgar Russel, S. C., to be colonel from April 12, 1917, vice Col. William A. Glassford, retired.

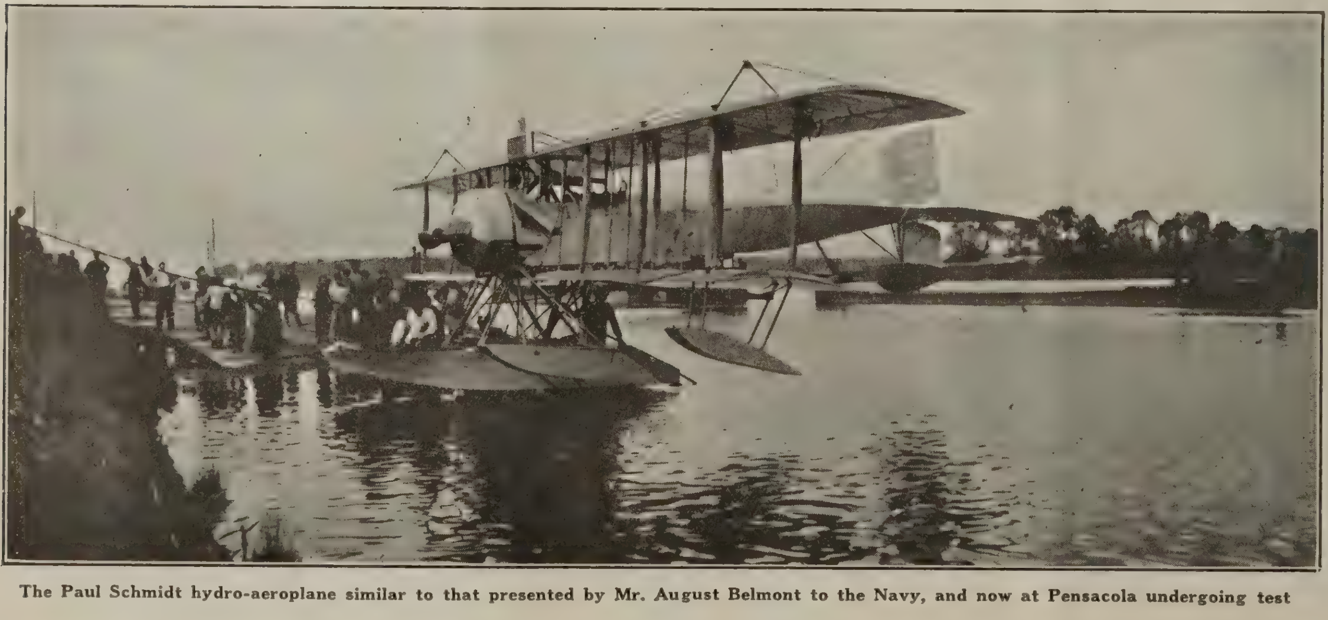
Major Carl F. Hartmann, S. C., to be lieutenant colonel from April 12, 1917, vice Russel, promoted.

Capt. Alfred T. Clifton, S. C., to be major from April 12, 1917, vice Hartmann, promoted.

Capt. Shepler W. FitzGerald, Junior military aviator, S. C., to Gloucester, Mass., about April 23, 1917, for temporary duty at the Hammond Research Laboratory. (April 20, War D.)

The following promotions and appointments in the Aviation Section of the Signal Corps are announced: To be master signal electricians: Sergts. 1st Class Evert L. Moore, John W. Corcoran, John Dolan, Robert Robertson, Calvin T. Stevenson, Arthur B. Neiswander, Leo C. Tobin, William G. Martin, Harry T. Lewis, Charles Payne, Alexander B. Culp, Clarence P. Young, Samuel Katzman, Isaac P. Blade, Walter Brewer, Nemo S. Jolls and George D. Litherland, April 16, 1917. To be sergeants first class: Sergts. Clarence F. Adams, Herbert J. Bertram, Roy S. Showalter, John Pollok, Samuel Hurdus, Clarence H. Maranville, Neil H. Harring, Clyde B. Hamlin, Harry V. Hand, John C. Tureck, Harry E. Weightman, Jacob Anderson, James Murray, John Ross, Henry A. Bergman, Thomas F. Randle, Frank Krick, James MacFadden, Charley B. Ammen, Frank C. Behrend, George W. Kellems, William A. Bechtold, William C. Hunter, Alvah E. Baxter and Charles W. Winters, April 16, 1917. To be sergeants: Corpls. Arthus R. Curphey, Alfred J. Ralph, Oscar Young, David M. Jones, James A. Reardon, Max Miller, Harry Turner, Walter Hannefield, Clarence L. Sanders, George C. Kull, Lawrence G. Wirth, Lawrence M. Gordon, Walter Hitzfeldt, Howard J. France, Lee O. McQuitty, Andrew Anderson, Nick Roeser, Willard W. Warren, Charles O. Watson, Frederick Jansen, Claude E. Fessler, Carl W. Bradbury, Paul A. H. Bellings, Donald Smith, Alexander J. Anderson and William A. Fox, April 16, 1917; Cook Harry F. Gosnear, April 16, 1917, and Pvts. Irwin N. Zuber, March 25, 1917, and Paul J. Corn, April 2, 1917. (April 16, S. O.)

Master Signal Electrician Leon E. Harper, S. C., at Nogales, Ariz., to Manila on transport to leave May 5 for duty. (April 21, War D.)



The Paul Schmidt hydro-aeroplane similar to that presented by Mr. August Belmont to the Navy, and now at Pensacola undergoing test

RUBBER HOSE FOR USE ON AEROPLANES

By PERCY A. HOUSEMAN*

THE enormous increase in the world's output of aeroplanes during the last three years has rendered important a systematic inspection of materials used in their construction.

One of the materials requiring detailed examination is rubber hose, which is held to be the most desirable material for conveying gasoline from the tank to the engine on aeroplanes.

It was found, at the time that a system of inspection for aeroplane materials was initiated in England, that the quality of the rubber being used was quite unsatisfactory. This was probably due in a large measure to the unfamiliarity of the rubber manufacturers with the properties required of gasoline-resistant rubber hose. They appear in some cases to have endeavored to adapt their regular types of material, such as steam- or water-hose, for use with gasoline, with results which were sometimes disastrous to the life of the aeroplane and to its pilot.

The Underwriters' Laboratories of Chicago have published (May, 1914) their requirements for rubber hose to conduct gasoline, and their tests are very thorough. When the hose is to carry gasoline on aeroplanes some modification of the Underwriters' examination seems desirable. Bursting, tensile, and stretch tests on the original hose are described by the Underwriters, and tensile strength is also determined 24 hrs. after gasoline immersion. It may be pointed out that after such a period the rubber recovers, with little deterioration, its original physical properties. It is important to obtain a hose which will show good physical behavior while immersed in gasoline or immediately after removal therefrom. Bursting and tensile tests were given up as specification tests by the writer because, although they furnish helpful information, it was found that they were not adequate to detect tubes which would behave badly towards gasoline when used on aeroplanes.

In drawing up specifications for gasoline-resistant rubber tubing, the following tests were carried out, and found to be suitable for controlling the quality of the tubing.

They are intended to amplify and not to supplant the specifications of the Underwriters' Laboratories.

(1) FLEXIBILITY—The tube is bent to a circle having a diameter (D) which varies according to the inside diameter of the tube (d) as shown below:

d	D
Up to ½ in.	8 times d
9/16 in. to 1 in.	10 times d
1 1/16 in. to 1½ in.	12 times d
Above 1½ in.	14 times d

The diameter of the tube so bent should not change at any point by more than 10 per cent. from its original diameter.

A tube of poor flexibility will show a permanent weak spot if bent sharply a dozen times at the same place.

(2) IMMERSION IN GASOLINE—At first an immersion test of 200 hrs. in cold gasoline of about 0.720 sp. gr. was used. It was found that approximately the same effect can be attained in a shorter time by boiling in gasoline for 1 hr. under a reflux condenser, followed by 24 hrs.' standing in gasoline at room temperature. The approximate increase in weight and volume of the sample (about 3 in. long) is recorded for correlation with the results of the other tests. The decrease in bore at the narrowest part of the tube is also noted and should not exceed 25 per cent., otherwise the supply of gasoline to the engine may be seriously diminished, especially for tubes of less than ½ in. internal diameter.

The adhesion of the rubber to the canvas fabric must remain good, and the "nerve" of the rubber must not be seriously impaired when examined immediately after the gasoline treatment.

This test of strength of adhesion of rubber to canvas, and for retention of "nerve" of the rubber is open to the objection of being too vague, but it was not found expedient to incorporate standardized tests for these properties, and in actual practice no difficulty was ever experienced in judging whether or not a sample passed the test. This test is also a rough guide to the amount of free sulfur present, crystals of sulfur being deposited from a tube containing an excessive amount.

(3) PERMEABILITY TO GASOLINE—A 14 in. length of the tube is held vertically and plugged with a glass stopper at the bottom. A glass tube is fitted to the top, and is filled with gasoline to a head of 12 in. above the top of the rubber tube, and then loosely stoppered. The length of rubber tube exposed to the action of the gasoline is 12 in. At first the gasoline is absorbed comparatively rapidly by the rubber. The level of the gasoline in the glass tube should not be allowed to fall more than 3 in., additions of gasoline from a known volume being made as necessary. The amount of gasoline which permeates through the walls of the rubber tube is noted during the first and second days, as a guide to the behavior of the sample. During the third 24 hrs., by which time the rate of permeation has become approximately constant, the amount of gasoline passing through the tube should not exceed 100 cc. per sq. ft. of original internal surface of the rubber tube.

(4) DRY HEAT—A piece of the tube is heated for 2 hrs. at 132° C. The rubber should remain elastic after this treatment, and should show no signs of stickiness or brittleness, nor should any surface cracks become visible on stretching the sample.

(5) COLD—The tube is immersed in carbon dioxide snow, which was found to render all tubes brittle while they remained cold. The rubber regains its elasticity on attaining room temperature again, and this test was, therefore, discontinued.

(6) BURSTING PRESSURE—Tests on bursting pressures were carried out before and after the permeability test, but were subsequently given up, as it was found that the quality of the tube could be sufficiently safeguarded by the other tests, and, moreover, the pressure to which the tube is subjected in actual service is very slight.

(7) ACETONE EXTRACT, FREE SULFUR, MINERAL SULFIDES, AND SULFUR OF VULCANIZATION are also determined, and furnish useful information in forming a judgment as to the quality of the specimen under examination. The free sulfur should not exceed 1 per cent. of the weight of the finished tube (exclusive of the canvas). Excessive free sulfur will be carried by the gasoline into the cylinders of the engine where it may promote pitting.

(8) ASH—A portion of the rubber is incinerated very slowly, and the amount and composition of the ash determined.

(9) QUALITY OF CANVAS—Tests on the quality and strength of the fabric inserted in the tube were contemplated, but it was found expedient to leave to the judgment of the manufacturer the kind of fabric to be used, relying on the tests already enumerated to control the production of a satisfactory tubing.

When the examination of rubber hose for use with gasoline was commenced, great diversity in construction, composition and behavior was found. Some makers appear to have believed that vulcanized rubber is essentially non-resistant to the action of gasoline, and therefore put as little of it in the tubes as possible. Some tubes yielded as much as 75 per cent. ash, while others gave less than 40 per cent. As great a diversity was found in the composition of the ash. Barium sulphate, lead, zinc, calcium and magnesium were found in a great variety of proportions, each manufacturer carefully guarding his own "mixings" and considering them of vital importance for the production of a satisfactory tube. Some typical figures of ash analyses are appended. The figures for total ash are percentages of the finished tube, excluding the canvas.

TABLE I

TOTAL ASH AND ASH ANALYSES OF GASOLINE-RESISTANT RUBBER HOSE

Description of Tube	Total Ash Per Cent	Percentages of Total Ash				
		$BaSO_4$	PbO	ZnO	CaO	MgO
French No. 1....	51	26	10	..	26	10
French No. 2....	42	20	..	5	34	20
British 1-A......	72	43	3	4	..	21
British 1-B......	73	44	35	4	..	4
British 1-C......	45	51	34	5	1	1
British 1-D......	45	40	..	5	33	13
British 2-A......	49	..	47	..	5	37
British 2-B......	39	10	18	27	26	..
British 2-C......	38	..	37	..	4	34
British 2-D......	43	19	18	3	26	4
British 2-E......	39	..	27	..	5	46
British 3-A......	68	..	36	34	5	..
British 3-B......	41	..	..	24	25	25
British 4-A......	45	46	..	29	4	10
British 4-B......	60	72	..	7	12	1
British 5-A......	59	28	6	7	31	..
British 6-A......	44	..	40	13	2	29
British 7-A......	61	..	60	8	..	3

French No. 1 was not a very good tube. The rubber was somewhat harsh. The tube failed to pass the flexibility test, but was satisfactory for permeability. The adhesion between rubber and canvas at the end of the immersion test was fairly good, but the tube contained as much as 3 per cent. free sulphur. The heat test caused obvious deterioration in the quality of the rubber. Barium sulphate and lime are the chief mineral ingredients.

French No. 2 was inferior to No. 1. The rubber was harsh, and its behavior varied along the length of the consignment, indicating probable uneven vulcanization. Mechanical defects, such as local pitting, were to be seen. The adhesion of rubber to canvas after immersion appeared at first sight to be very good, but this was due rather to the ease with which the rubber itself tore. Lime and magnesia are the most prominent minerals, with barium sulphate as a diluent. Rubber hose for use with gasoline on French aeroplanes is required to contain 45 per cent. mineral matter with a margin of ± 5 per cent., 50 per cent. rubber with the same margin, and to have a density of 1.6 (±0.1).

British 1-A to 1-D, though all from the same make, show wide variations in total ash and in the composition of the ash. The bad feature of both 1-A and 1-B was the weakness of the adhesion between rubber and canvas. Separation of the plies occurred spontaneously under gasoline. The other properties of these tubes were satisfactory. 1-D was a good tube.

British 2-A to 2-E, all made by one firm, show less variation in total ash, but much variation in the composition of the ash. 2-A and 2-B represent respectively outer and inner rubber layers of the same tube. The same applies to 2-C and 2-D. The inner layer of rubber proved to be of better quality for use with gasoline than the outer layer. The adhesion between rubber and canvas was bad. Tubes 2-A and B showed high constriction of the bore. All of these tubes contain a considerable quantity of lead, and 2-E is noticeably high in magnesia.

British 3-A and 3-B—3-A showed bad "adhesion"; 3-B very good adhesion, though the rubber was rather "short" after the immersion test.

British 4-A and 4-B—The product of this firm showed great variability in bore-constriction, but the flexibility, permeability, adhesion after immersion test, and quality of rubber after immersion test were all good.

British 6-A was a good tube. *British 7-A* was too harsh.

A large number of other tubes were examined but most of them showed defects in one or more of the properties tested. Some manufacturers used a certain amount of reclaimed rubber or of rubber substitute, but it is believed that this is not desirable as regards the quality of the product, although it lowers the cost.

One firm made an excellent tube by the use of 45 per cent. Para rubber. The mineral ingredients in this tube were lead, calcium and magnesium. This tube withstood the immersion test with hardly any deterioration in the "nerve" of the rubber, and the adhesion between rubber and canvas was scarcely affected. The bore constriction after immersion test was less than 25 per cent. on a ½-in. tube, and all of the other tests gave good results.

It is probably undesirable to use less than 40 per cent. rubber.

In many cases it was customary to insert a spiral of brass or steel wire in the bore of the tube so as to improve its flexibility. This practice is unnecessary if the walls of the tube are made fairly thick, and in the case of the brass spiral constitutes a possible source for the entry of copper into the rubber.

It was found that a decided improvement in some of the properties of gasoline-resistant rubber hose could be achieved by changing the manner in which the canvas was inserted. The usual method was to friction the canvas with a very thin layer of the rubber mixing, so that in the finished tube there were virtually three plies, an inner layer of rubber, a middle layer of canvas, usually from 2 to 4 turns according to the size of the tube, and an outer layer of rubber. When a tube made in this manner is subjected to the immersion test the three layers expand at different rates, resulting often in spontaneous separation. The canvas layer expands hardly at all, and so the expansion of the inner layer of rubber is forced inwards, with consequent constriction of the bore. A better method of construction consists in spreading a definite layer of rubber on the canvas, so that in the finished tube the thickness of rubber between each turn of the canvas is at least twice as thick as the canvas itself. A cross-section of a tube made in this way shows the canvas to be distributed as a spiral through the whole thickness of the wall of the tube. Such a tube shows improved flexibility and better behavior under the immersion test, there being less tendency to separation between rubber and canvas and a smaller constriction of the bore. For tubes up to ⅝-in. internal diameter, two turns of canvas are sufficient. Between 11/16 in. and 1¼ in., three turns are desirable, and for tubes larger than 1¼ in. internal diameter 4 turns of canvas should be used. The larger sizes are used for oil or water.

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THE 1916 TYPE GERMAN AVIATIK BIPLANE

German pilots affirm that they have climbed with the Aviatik as high as 15,750 feet with their observer and 18.5 gallons of gasoline. The recognized maximum climb is about 11,500 feet with a useful load of 750 pounds.

Tests in France show the following results for speed and climb: Speed at 1,000 metres, 79 m.p.h.; 2,000 metres, 74½ m.p.h.; 3,000 metres, 66 m.p.h. Climb to height of 500 metres, 4½ minutes; 1,000 metres, 9½ minutes; 2,000 metres, 21½ minutes; 3,000 metres, 47½ minutes.

Aviatiks with Benz and Mercedes motors of 220 h.p., differing from the 170 h.p. motor in cylinder bore only, as said to be building. These are to have two machine guns, one of which will fire through the sweep of the propeller, and having a speed of 93 m.p.h. at an altitude of 2,000 metres.

General Dimensions

Wing Span, upper	40′-8″
Wing Span, lower	35′-5″
Chord	6′-1″
Gap	6′-4″
Length over all	25′-4″
Height over all	10′-3″
Weight, empty	1,831 lbs.
Useful load	968 lbs.
Motor, Mercedes	170 h.p.
Speed range (at sea level)	82-49 m.p.h.

Planes

The planes are practically rectangular in shape. Sweepback about 1 degree, 10 minutes. Angle of incidence, 4 degrees, 38 minutes. Dihedral about half a degree.

Wing spread, upper plane, 40′ 8.1″, and lower plane, including the body, 35′ 5″. Chord, 6′ 1″, making the total wing area 430.56 sq. ft., including the surface of the ailerons. Ailerons on upper plane are 7′ 3.6″ long by 2′ 5.1″ wide; surface 17.22 sq. ft. Trailing edge of the aileron rises toward the wing tip, presenting a negative angle at the extreme outer edge.

The wings weigh 308 lbs. Interplane struts weigh 28 lbs.

Fuselage

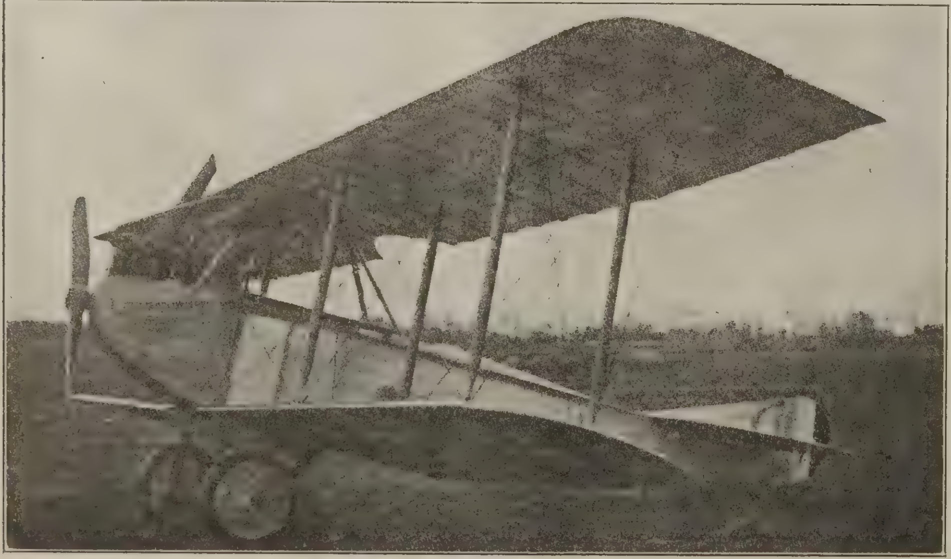
The body is quite similar to the Rumpler and Albatros. It is of box-girder construction with bevelled spruce cross members wired with diagonal stays of piano wire. Fittings are such that the longerons are not pierced.

The cockpit is built of steel tubing. The cockpit frame is of round tubing and the slanting struts supporting the upper plane are of elliptic section.

The body is practically entirely of wood. The four main longerons are of ash, wrapped with fabric from the front of the machine to the back of the rear seat, and from there on of unwrapped pine. Longerons are of constant section throughout their length. The top of the body is covered with arched plates of aluminum.

Steps for access to the cockpit fold inside, and do not project outside the body.

Controls are of the Deperdussin type with aileron cables passing inside the lower planes. The rudder is controlled by a foot bar provided with heel rests of metal.



1916 Aviatik—three-quarter front view.

1916 Aviatik—close view of motor mounting.

Landing Gear

The tread of the landing wheels is 6′ 2.75″. Struts are of elliptic tubing and internally reinforced with wood. The landing gear is held in shape by an oval cross member, horizontal cables and steel cable cross stays. The axle rests inside the points of the two Vs, and is attached to a short tubular horizontal member by means of rubber cord.

The tail skid is of wood, all outside of the body, hanging on a pivot and held in place by rubber rings located inside the body. Underneath it is attached by a metal fitting which encloses the body termination and to which the rear end of the vertical fin is attached.

Tail Group

The stabilizer is fixed and measures 9′ 2.2″ by 4′ 10.2″. Upper fuselage longerons slope downward toward the rear, and the stabilizing plane being placed upon them gives it an angle of incidence of minus 58 minutes to the wings. A projection of the propeller axis passes 5.51 inches below the rear of the stabilizing plane.

Area of the stabilizing plane, including the portion covering the fuselage, is 35.52 sq. ft.

The elevator is in the form of two semi-oval surfaces between which the rudder is pivoted. Over all dimensions of each, 4′ 3″ by 2′ 2″. Elevator area, 12.07 sq. ft.

The rudder is balanced. Height, 3′ 0″, depth 2′ 3.5″; the balanced part adds 10.63″ to the depth. Area, 6.45 sq. ft. including the balanced part which has an area of .81 sq. ft.

The fixed fin is 5′ 1″ long by 2′ 5.5″ high at the rear. Area, 3.23 sq. ft.

Elevator, rudder and fin are built of steel tubing .47″ outside diameter. Edges of stabilizer of .98″ tubing, with ribs of wood. Front edge of elevators of .98″ tubing.

Armament

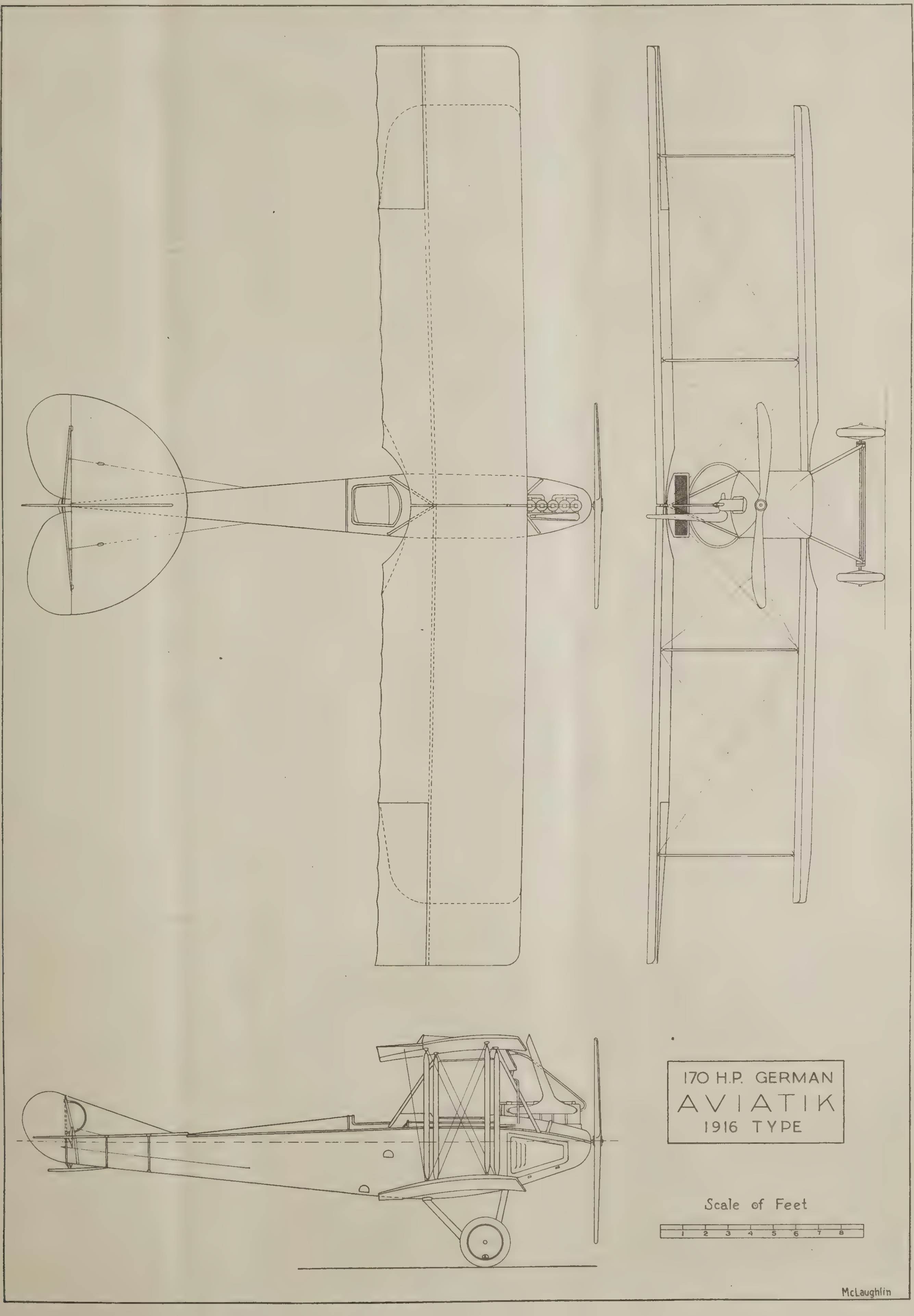
In front of the pilot, at either side of the body, are two 8.46 inch bomb-launching tubes of sheet metal. The trigger for releasing the bombs is fitted with a spring and the passenger operates it by pulling a cable.

Machine guns are mounted on elliptic tubes curving above and outward from the fuselage. The guns can be fired in nearly any direction rearward and forward except in the direction of the area traversed by the propeller.

Power Equipment

Mercedes motor of 170 h.p. This motor was completely described in the issue of September 11, 1916. Bore and stroke, 140 mm. by 160 mm. Estimated h.p. 170 at about 1,300 r.p.m.

Weight of motor, 673 lbs.; propeller, 42 lbs.; cooling water, 55 lbs.; fuel, 418 lbs. The fuel is calculated for a flight of 4½ hours' duration.



170 H.P. GERMAN
AVIATIK
1916 TYPE

THE MECHANICAL DEVELOPMENT OF AVIATION

By NEIL MacCOULL, M. E.*

AVIATION is one of the most fascinating branches of mechanical engineering. It seem as if it were born in mankind of all ages to long for the mastery of the air,—the mythology of all peoples is filled with evidences of it. Most of us have been raised from childhood on such stories as those of Daedalus and his son Icarus, who attached large birds' wings to their backs by means of wax and flew from Crete to Italy, though Icarus flew too near the sun and the wax melted; or on the story of the winged horses of the Valkyrie in Norse mythology, who flew between the battlefields of mortal man and Valhalla, carrying the bodies of great heroes to their eternal reward in the home of the gods.

The reason for this romantic interest in aviation for the layman is out of my province to explain, but it is easy to put one's finger on the cause of the interest which an engineer takes in this subject. Engineers have always experienced keen delight in tackling and solving difficult problems, and the intensity of the pleasure has increased somewhat as the cube of the difficulties encountered. It was the engineer who by constant patience, and toil, and discouragement and hazard of life, finally wrenched human flight from the fancy of poets and dreamers, and placed it in actual reality in the hands of modern civilization. The great bulk of what is nowadays called engineering offers but few real difficulties; it is merely a matter of producing a mechanism which will run satisfactorily and will be cheap: a matter requiring more common sense than brains, except for the financier who is back of it all. Knowledge of the underlying principles involved such as thermodynamics for example, is not at all essential in many instances, and is frequently not desired.

But the true engineer, the man who, like Alexander the Great, lies awake at night, and worries because of the lack of difficulties obstinate enough to give him an opportunity to try his ability to the utmost, will find aeronautics a field greatly to his liking. In spite of the apparent success of modern aircraft, there is such enormous room for development as to be a great attraction to the man who wants to show results; and the beauty of it is that any man who can improve on what is now being done will show such a vital knowledge of every minute detail of the subject as a whole, and the part he tackles in particular, that he can well be justified in experiencing a thrill of pride when the world examines his work—for we will all know that it was no accident.

It is a matter of historical record that actual experiments were made with artificial wings as far back as the early part of the seventeenth century. From that time on, many experiments were made which gradually led up to gliding flights with rigid wing surfaces such as used in the early experiments of the Wright brothers.

The earliest systematic experiments with mechanical power were started in 1889 by Sir Hiram Maxim. From the data obtained he constructed a very large twin propeller aeroplane in 1893, with steam as the motive power. The span of the wings was 104 feet, which to this day is exceeded only by a very few machines. The great amount of wing surface, and the perfect maze of wires and other parts producing air resistance is very noticeable when compared with modern machines. The total wing area was over 6,000 square feet, which is some twelve times as great as the average military aeroplane—but this was necessitated to a large extent by the fact that it was intended to fly at a speed of only 35 to 45 miles an hour. At such speeds, however, air resistance is not nearly so great as in modern machines which make well over 85 miles an hour. and probably accounts for the lack of any resemblance to the much talked of stream line shapes of today. In the experiments with this machine, the running gear was provided with flanged wheels which ran on a straight level track of 9-foot gage. Strong wooden guide rails of 3 by 9 Georgia pine were constructed along the track in such a way as to prevent the aeroplane from leaving it. Thus, actual flight was prevented, because control and stability were unknown factors and the first data required was only in regard to the ability of the machine to support its own weight. Quite elaborate recording instruments were provided for such quantities as speed and lift. This aeroplane not only lifted its own weight of 8,000 pounds, but also broke the stout plank guide rails which held it to the earth, and caused a wreck. But in spite of being able to support itself it could not be called a successful aeroplane, because its stability and airworthiness were never demonstrated in free flight. In fact, it seems questionable now, that it could have ever been airworthy. The power plant, however, was the one part of this machine which was demonstrated to be successful and is sufficiently interesting to warrant more attention, for I doubt if there has ever been a steam plant of its size which weighed so little as 11 pounds per horsepower, including boiler, engines, condensers, pumps and water supply.

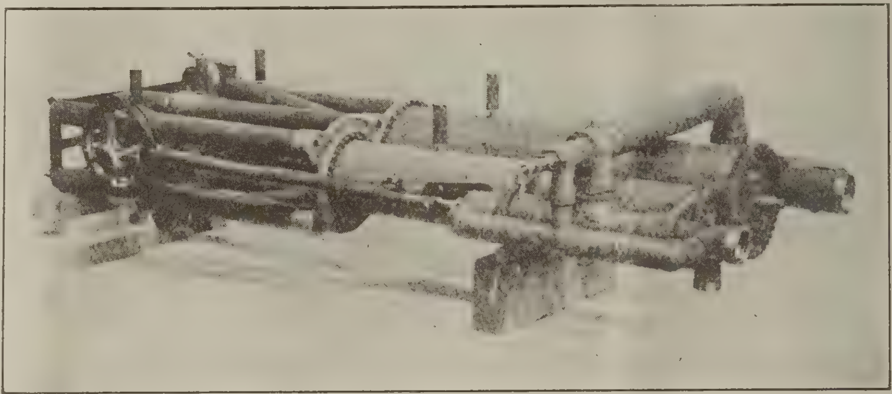


Fig. 2. One of the compound steam engines of Maxim's Aeroplane

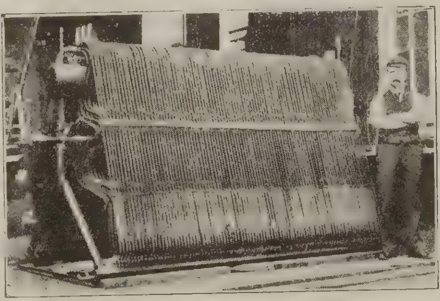


Fig. 3. The oil burning boiler used for both the engines on Maxim's aeroplane

Each of the two propellers, which were 17 feet 10 inches in diameter, was directly connected to a double acting compound engine, with cylinders 5 and 8 inches bore, and a stroke of one foot, high pressure cut-off being at ¾ stroke, and low pressure at ⅝. These engines were constructed almost entirely of high grade cast steel and were very light, weighing but 320 pounds each, complete. With a steam pressure of 320 pounds per square inch, each developed 180 horsepower at 375 r.p.m.,—a weight of only 1¾ pounds per horsepower. A species of safety valve was provided which would discharge into the low pressure cylinder, thus adding considerably to the power when there was an excess of steam.

The boiler which supplied the steam for both these engines was equally a masterpiece. It was constructed of a very large number of ⅜-inch copper tubes 1/50 of an inch thick, and had a heating surface of about 800 square feet, including the feed water heater. It must be realized that tubing such as this was quite a novelty in those days. A strong forced circulation of water was obtained by means of a spring loaded valve in the boiler, which held the feed water at a pressure of 30 pounds per square inch in excess of the boiler pressure. This fall of 30 pounds in pressure acts upon the water in the tubes and forces it down through the large outside tubes shown at the left. Although this boiler with the casing, dome, smokestack and connections weighed less than 1,000 pounds, it supplied all the steam that the engines could possibly use. The weight of the engines and boiler totaled 1,640 pounds, or about 4⅓ pounds per horsepower.

The condensers were made of very thin copper, the individual tubes being shaped somewhat like miniature aeroplane wings in section. By this means they were made to sustain more than their own weight when the aeroplane was traveling at its normal speed.

At almost the same time that Sir Hiram started his experiments, Samuel Pierpont Langley the real "father of aviation," was learning the fundamentals of aerodynamics by means of models with rubber motors. After years of experimentation in which astonishing difficulties were successively encountered and overcome, data was finally accumulated which led to the construction of successful steam driven models. While great difficulty was encountered in developing the aerodynamic properties of the models, even greater difficulty was experienced of a mechanical nature when attempts were made to use steam as a motive power. Mr. Langley acknowledges in his "Memoirs" that he had no professional acquaintance with steam engineering, but that none of the counsel obtained from those possessing more knowledge was useful in meeting the special problems which presented themselves, and which were solved only by constant trial and error.

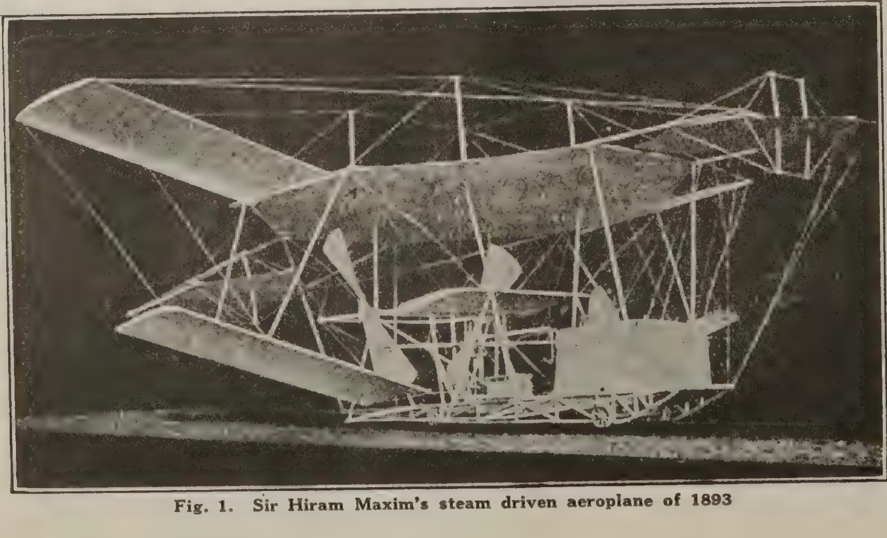


Fig. 1. Sir Hiram Maxim's steam driven aeroplane of 1893

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* The Westinghouse Machine Co.

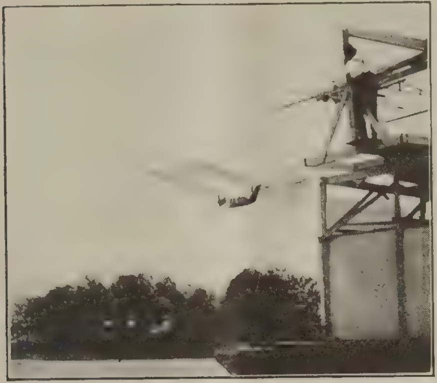


Fig. 4. Prof. Langley's steam driven model just after launching

Out of all the experimental development of nine years of strenuous work, there was evolved a steam driven model known as No. 5, which had a wing spread of 13 feet, and which weighed 26 pounds complete. On the afternoon of May 6, 1896, this model was launched over the Potomac River with a steam pressure of 150 pounds, and started directly ahead into the gentle breeze which was then blowing. After launching it slowly descended three or four feet, but immediately began to rise, and at the same time circled to the right and moved around with great steadiness, traversing more than two complete spirals. After the lapse of one minute and twenty seconds, when at a height of from 70 to 100 feet, the fuel was exhausted and the aeroplane gradually descended until it finally touched the water after a flight of one minute and thirty seconds, in which a distance of over 3,000 feet had been covered. This was the first time in the history of the world that a mechanical device produced by man had actually flown through the air under its own power, and had maintained its own equilibrium.

At this point it is interesting to observe that our own government is experimenting with models of a somewhat similar type for carrying high explosives—which models are otherwise spoken of as aerial torpedoes.

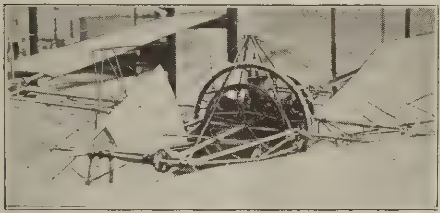


Fig. 6. The five-cylinder radial gasoline engine used in the successful flights of the quarter size model of Langley's man-carrying aeroplane

Fig. 4 shows the model in flight just an instant after it was launched. It was of the tandem monoplane type, with one set of wings in front of the other.

The engine was a single cylinder 1 5/16 by 2¾-inch double acting type with piston valve, and drove the two propellers through bevel gears. It delivered about ¾ horsepower and weighed barely 1 pound. The complete power plant, including engine, flash boiler, pumps, tanks, valves, burners and piping, weighed less than eight pounds, which is under 11 pounds per horsepower; an exceedingly creditable result.

The mechanism at the right is the launching device mounted on the roof of the houseboat. Mr. Langley started all his power driven aeroplanes from a sort of catapult, in which the aeroplane was held to a carriage running on a track and was released after traveling the length of the track under the impulse of coil springs. Langley's large man-carrying aeroplane, Fig. 5, which was tried out in 1903, was launched from a similar device, and failed to make successful flights on account of some accident which tripped the machine just as it was leaving the car and threw it into the water.

This happened twice, and caused so much ridicule in the press that Mr. Langley was unable to get any further financial aid. He died in 1906 without having had the satisfaction of seeing his aeroplane fly. A few years ago Glen Curtiss repaired this aeroplane and by fitting it with pontoons so that it could rise from the water, was able to make a very pretty flight, proving it to have been the first absolutely successful man-carrying aeroplane ever built. What a pity it is that Mr. Langley was not able to see that flight!

It will be recalled that the Wright brothers used a launching device operated by falling weights in all their early experiments, and a similar catapult is now used for launching aeroplanes from battleships in our navy.

As an outcome of this successful model and another similar to it, President McKinley became interested in the military possibilities of aircraft, and in 1898 caused the Board of Ordnance and Fortifications of the War Department to authorize and finance the construction of a man-carrying aeroplane under Mr. Langley's direction. It was decided that the new machine should follow the general type of the models as far as practicable because heartrending difficulties experienced during the preceeding eleven years had taught that even a slight departure from the type that had proved successful, might be very costly.

The great difficulty to be overcome with the large machine was the power plant, which even today is the source of the greatest troubles with aeroplanes. The possibility of using steam was seriously considered because of its success on the models, but it was decided that in order to get a plant light enough it would be exceedingly delicate, and the internal combustion engine which was just coming into prominence in automobiles, seemed to offer a more satisfactory solution. At that time practically no thought was given to efficiency because flights of sufficient duration for the weight of fuel to become serious, were not yet considered seriously. If they had been, but little attention would have been given to steam because the most efficient practical steam plant of small size which has yet been constructed, uses twice as much fuel as the best modern internal combustion engines. Even for very short flights where fuel weight is not important, the weight of boiler, condenser, pumps, etc., even in Maxim's phenomenally light plant, was over twice as heavy as Langley's large internal combustion engine which was made later. For this reason it is astonishing to hear rumors at present of responsible organizations contemplating the use of steam turbines for aeroplanes. The turbine itself can be made very light, but the weight which would be saved over a reciprocating engine, would be lost by the weight of the reduction gear required to drive the propeller at the proper speed.

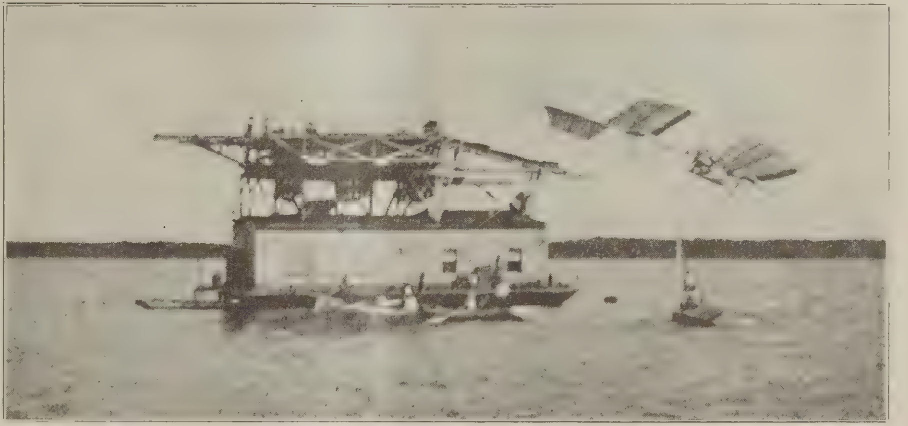


Fig. 5. Langley's man-carrying aeroplane

In December, 1898, a contract was signed with an engine builder in New York City to supply a twelve horsepower engine weighing not more than 100 pounds, delivery to be made in six and one-half weeks. Strange as it may seem to modern engine builders, the engine was completed before the elapse of the contract time,—but it was impossible to get it to deliver more than 4 horsepower for some unaccountable reason. It was the first air-cooled revolving engine ever built, and the problems which developed were too much for the builder. A quarter size model have fixed cylinders with cooling ribs, performed excellently. But in the mean time European engine builders were interviewed with the hope that some one of them would undertake the construction of a satisfactory engine. Everywhere the builders said that they did not care to undertake the work, and that they did not consider it possible to construct an engine of 12 horsepower weighing less than 200 to 300 pounds, and that, if they had thought it possible, they would already have done so, as they had had numerous inquiries for such engines. In spite of the discouragement Mr. Charles Manly, who was assisting Mr. Langley, offered to undertake the construction of the required engine from the parts of the unsuccessful engines built in New York.

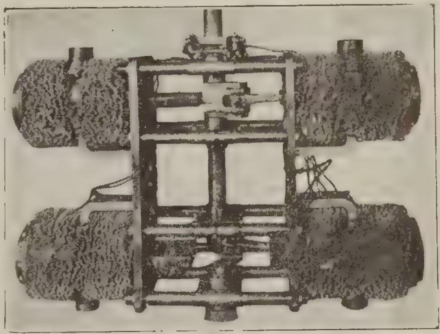


Fig. 8. One of the Freak air-cooled gasoline engines developed while the art of flying was very young

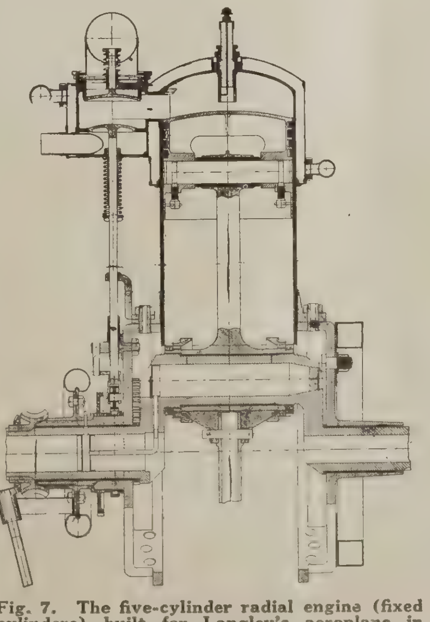


Fig. 7. The five-cylinder radial engine (fixed cylinders) built for Langley's aeroplane in 1901

The five cylinder water-cooled radial engine shown in Fig. 7 was the outcome of his efforts. Each cylinder of this engine was drawn from a 3-16 inch steel plate by Mr. Joseph Stimmetz, and machined inside and out, leaving a 1-16 inch shell. To this shell was brazed the valve chamber which had been machined from a solid forging. The jackets of sheet steel only 0.020 of an inch thick, were brazed on by Mr. Manly himself, since no one could be found who would undertake the work. In spite of the trouble involved, it was less difficult than to deposit copper jackets electrolytically, so undeveloped were these processes only fifteen years ago. In order to minimize the lubricating difficulties which might have been experienced if the pistons were to bear directly against the steel cylinders, cast iron liners 1/16 inch thick were shrunk in. Even though engine builders had declared such construction impractical, if not impossible, no trouble was ever experienced with these liners, and they served their purpose admirably. The difficulties encountered in attaching five connecting-rods to one crank-

(*Continued on page* 261)

D'ORCY'S AIRSHIP MANUAL

(Continued from page 221)

GERMANY

Dorhöfer, Cologne—Builder of a pressure airship of the car-girder type. Trim controlled by lifting planes.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	Dorhöfer (1910)	28	7	1,000	60		Experimental airship.—One Mercédès engine; one tractor-screw. Failed on her trials.

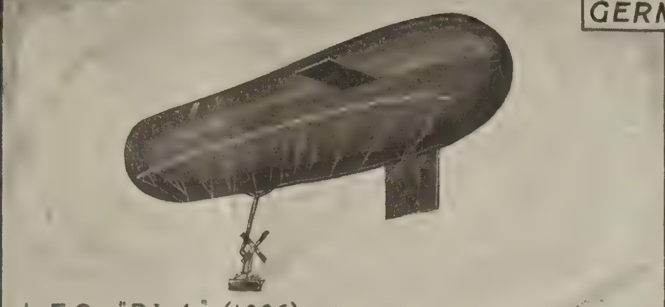
Baumgartner, Berlin—Builder of a pressure airship, in association with Herr Woelfert. Trim controlled by ballast.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	Baumgartner (March, 1882)	17.5	8				Experimental airship.—One pusher-screw, operated by hand. No appreciable results were obtained. Herr Baumgartner having given up the venture, Herr Woelfert continued the experiments alone (See *ibidem*).

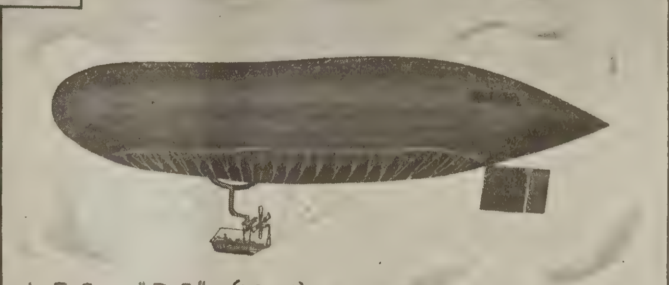
Luft-Fahrzeug-Gesellschaft ("L.F.G."), Berlin—Builders of girderless pressure airships to the patents of Major Von Parseval. Automatically shifting cars with self-blocking device for altering trim, combined with two compensating ballonets. Works at Bitterfeld (Saxony).

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
P. L. 1	P. L. 1 (May, 1906)	48.5	8.6	2,300	35	36	Experimental airship.—One Mercédès engine; twin-screws. Was re-built and refitted with one Mercédès engine driving one pusher screw. Purchased by the Imperial Aero Club of Berlin to serve for excursions. Dismantled 1911.
1a	(1909)	60	9.4	3,200	85	40	
P. L. 2	P. I. (August, 1908)	60	10.4	4,100	85	47	Prussian Army airship.—One Mercédès engine; twin-screws. Best endurance: 290 km. in 11½ hrs. Destroyed by the storm while landing near Grünewald, on Sept. 16th, 1908.
P. L. 3	P. II. (February, 1909)	70	12.3	6,600	200	51	Prussian Army airship.—Two N. A. G. engines; twin-screws. Designed endurance: 14 hrs. Made numerous ascents at the Aeronautical Exhibition of Frankfort (1910). Destroyed by the storm on May 16th, 1911.
P. L. 4	M. I.						Austrian Army airship, built to L. F. G. designs by the Motor-Luftfahrzeug Gesellschaft of Vienna (Austria).
P. L. 5	P. L. 5 (December, 1909)	40	8	1,450	25	36	Excursion airship of the L. V. G.—One Mercédès engine; one pusher screw. Designed endurance: 5 hrs. Was destroyed by a fire, on June 16th, 1911, at Münden.
P. L. 6	Stollwerck (June, 1910)	70	14	6,800	220	56	Excursion and advertisement airship of the L. V. G.—Two N. A. G. engines; twin-screws. Was re-fitted with a new envelope. Ballonet: 2,400 mc. Made 250 trips covering 15,000 km. and carrying 2,300 passengers.
6a	(October, 1912)	75	15	8,000	220	59	
P. L. 7	Griff (October, 1910)	72	14	7,600	220	59	Russian Army airship.—Ballonet: 1,400 mc. Two N. A. G. engines; twin-screws. Best endurance: 7½ hrs.
P. L. 8	P. II. (February, 1913)	77	14	8,000	360	54	Prussian Army airship.—Two Maybach engines; twin-screws. Designed endurance: 20 hrs.
P. L. 9	P. L. 9 (October, 1910)	40	8	1,450	70	40	Excursion airship of the L. V. G.—Two Mercédès engines; twin-screws. Was re-fitted with one Körting engine when re-built to become a Turkish Army airship.
9a	August, 1913)	50	10	2,200	50	42	

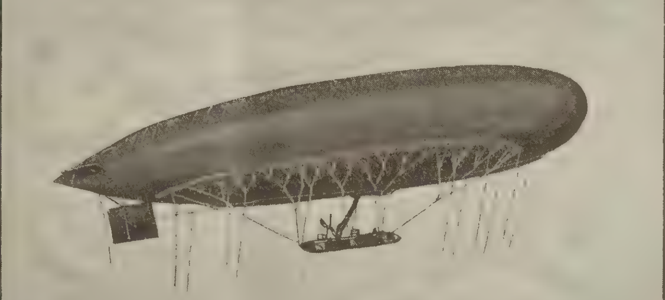
GERMANY



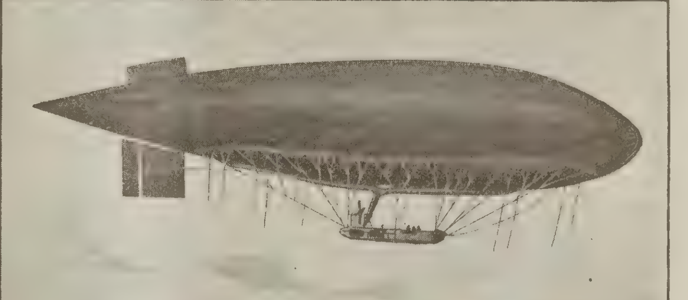
L.F.G.-"P.L.1" (1906)



L.F.G.-"P.I" (1908)



L.F.G.-"P.II" (1909)



L.F.G-"Charlotte" (1912)

Luft-Fahrzeug-Gesellschaft ("L.F.G."), Berlin—(continued)

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (k m)	Speed (h p)	Notes
P. L. 10	**P. L. 10** (1913)	**45**	**8**	**1,700**	**50**	**45**	Excursion airship.—One Körting engine; twin-screws. Was not completed until 1913, having remained four years on the yards.
P. L. 11	**P. III.** (December, 1911)	**84**	**15.5**	**10,000**	**400**	**65**	Prussian Army airship.—Ballonet: 3,000 mc. Two Körting engines, twin-screws. Best endurance: 16 hrs.
P. L. 12	**Charlotte** (May, 1912)	**79**	**15.2**	**8,800**	**220**	**54**	Excursion airship of the Rhenish-Westphalian Air Sport Co.—Two N. A. G. engines; twin-screws. Designed endurance: 20 hrs.; altitude 2,800 m. Ballonet: 2,300 mc.
P. L. 13	**Yuhi** (April, 1912)	**79**	**14.5**	**8,500**	**300**	**66**	Japanese Army airship.—Two Maybach engines; twin-screws. Designed endurance: 20 hrs.; altitude 2,000. Ballonet: 2,300 mc.
P. L. 14	(February, 1913)	**86**	**15.5**	**9,600**	**360**	**67**	Russian Army airship.—Two Maybach engines; twin-screws. Designed endurance: 20 hrs.; altitude 2,500 m. Ballonet: 2,700 mc.
P. L. 15	(Building, 1914)	**96**	**15.5**	**12,000**	**540**	**75**	Italian Army airship.—Three Maybach engines; two pairs of twin-screws. Requisitioned by Germany at the outbreak of the war. (Photo wanted).
P. L. 16	**P. IV.** (October, 1913)	**86**	**15.5**	**10,000**	**360**	**71**	Prussian Army airship.—Ballonet: 3,000 mc. Two Maybach engines; twin-screws. *P. L.* 14 class.
P. L. 17	**Città di Venezia** (September, 1912)	**85**	**15.5**	**9,600**	**360**	**69**	Italian Army airship.—Two Maybach engines; twin-screws. *P. L.* 14 type.
P. L. 18	**No. 2** (April, 1913)	**86**	**15.5**	**10,000**	**360**	**68**	British naval airship.—Two Maybach engines; twin-screws. Designed endurance: 20 hrs.; altitude 2,500 m.
P. L. 19 **P. L. 20** **P. L. 21**							British naval airships, built to L. F. G. designs by Vickers Sons & Maxim, Ltd.
P. L. 22	**P. V.** (1914)	**96**	**15.5**	**12,000**	**540**	**75**	Prussian Army airship.—*P. L.* 15 type. Three Maybach engines; two pairs of twin-screws. Was shot *(Continued on page 261)*

THE G. V. MONOSOUPAPE GNOME

WHAT American enterprise and workmanship can accomplish when the gauntlet is thrown down is evidenced by the performance in actual warfare of the first one hundred American built Gnome Monosoupape engines shipped to the British Admiralty. In material and workmanship, as well as in developed horsepower, they were pronounced equal in every way to similar engines produced after years of specialization in France and England.

Rotary aeroplane engines, and particularly those of the Gnome type, are used almost exclusively in scout and pursuit planes. The Monosoupape (single valve) Gnome, the American rights for which are controlled by The General Vehicle Company, Long Island City, is of 100 h.p. at 1,200 r.p.m. and develops great speed. It has nine cylinders.

The Gnome originated in France about eighteen years ago and mechanically is one of the most beautiful, if intricate, of all aero motors. The workmanship necessary for its manufacture is so fine that before the war made thousands of light speed planes necessary, its successful production in America was thought out of the question.

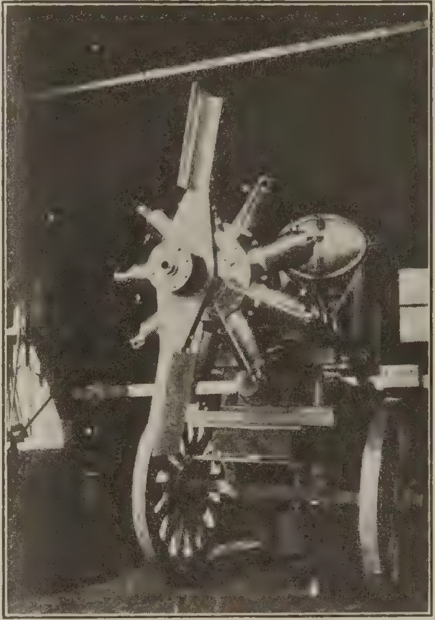
Think of producing an aeroplane engine which will give one horsepower for every 2.7 pounds of weight and you will have some idea of the fine alloy steels necessary to start with. The selection of the proper materials alone consumed over half a year before orders for these were placed, and even to-day, after manufacturing scores of such engines accepted for export, the metallurgists of the General Vehicle Company test every forging.

It is American capacity for fine workmanship of this class which is worrying those officials at Washington who appreciate the demands which war would make upon us. The experience necessary to perfection is often a question of years. Shell production is in most cases child's play compared to the manufacture of high grade aero engines of the rotary type. Yet these are necessary for the high speed planes now recognized as absolutely essential in air supremacy.

The Gnome is the scout of the air fleet. Planes equipped with stationary engines excel in their field, but light weight coupled with high speed is what makes the scout plane possible. As evidence of the elimination of weight on the Monosoupape Gnome study these figures: The forging from which the distribution case is made weighs 201 pounds; the finished case (all one piece), 15½ pounds. The cylinder forging, 88 pounds; the finished cylinder, 5½ pounds. The "mother" rod, that odd looking integral piece to which are secured the other eight rods, is reduced from 21 to 5½ pounds. The nine cams, weighing a few ounces each, have a tensile strength of 264,000 pounds to the square inch. The entire engine calls for work within 4/10,000 of an inch.

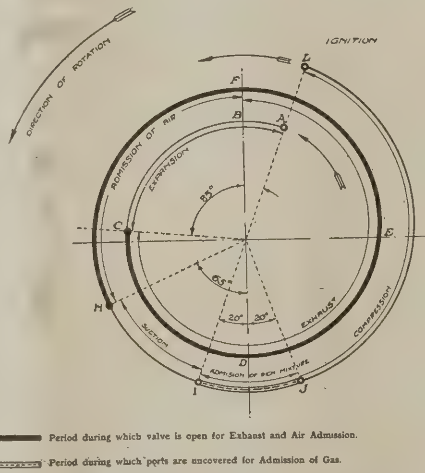
The sole American rights for the 100 h.p. Monosoupape Gnome engine have been secured by the General Vehicle Company under arrangements with the Gnome & LeRhone Engine Company of London. The United States Government, after inspecting many of the G. V. built engines ready for shipment abroad and checking up their performances on the other side, purchased over one hundred engines for army and navy use.

While great things are expected of other types of American built engines, Government officials have expressed themselves as highly gratified to know that no great difficulty will now be experienced in obtaining highly efficient engines of the rotary type manufactured in this country. It is understood that plans are under way for the extensive manufacture of Monosoupape type engines for school purposes as well as for export to neutral and belligerent countries. In any event American skill has added another banner to its collection and another brick to the wall of industrial progress.



A rotary engine fitted with the test propeller

FIG. 2



▬ Period during which valve is open for Exhaust and Air Admission.

▭ Period during which ports are uncovered for Admission of Gas.

Diagrammatic explanation of the operation of the nine-cylinder Gnome engine

GENERAL DESCRIPTION

Construction—The construction of the "Monosoupape" (or single-valve) engine of both types is practically identical. Type A is an 80 h.p. seven-cylinder engine, and Type B is a 100 h.p. nine-cylinder engine. These engines have the same bore and stroke, *viz.*, 110 mm. and 150 mm., respectively.

The cylinders, valves, etc., of both types are interchangeable. The following description refers particularly to the Type B2 engine, of English manufacture, without control mechanism, but can be taken as applying generally to both types.

Characteristics—The characteristics of the "Monosoupape" engine, as compared with the ordinary Gnome engine, are:

(*a*) Absence of inlet valves.
(*b*) Solid piston heads.
(*c*) No carburetor.
(*d*) Non-explosive mixture in crankcase.

DESCRIPTION

The crankcase of the engine is made in two halves, fastened together by bolts, the two halves clasping the cylinders at their base. The cylinders are prevented from turning in their setting in the crankcase by keys.

Each Cylinder is drilled near the bottom with a number of circular ports connecting the interior of the crankcase with the cylinder.

The Ports are uncovered by the pistons near the bottom of the stroke, permitting a passage from the crankcase to the cylinders.

The Exhaust Valve and seating is fixed at the extreme outer end of each cylinder by means of the usual castellated ring nut. The weight of this valve is so adjusted that its centrifugal action, when the engine is rotating, is equal to that of the tappet rod and lever; and thus the use of counterbalance weights, such as are fitted to the rocking levers of the ordinary Gnome engine, is avoided.

The System of Connecting Rods is similar to the ordinary Gnome engine, and is composed of one master rod and eight small rods.

The Crankshaft, which is hollow, is in two parts, but the smaller half can be dismantled from the front of the engine. The rear or large end of the hollow crankshaft is open to admit air and contains the petrol jet, whilst the front nose extension is closed.

The gasoline is supplied from its reservoir to a union on the crankshaft, then passes along the copper pipe 30577 to the elbow 30717. The jet 30705 which projects into the crankcase is held on to a nipple with a ground conical seat by the screw 30706. It has eight holes which project the petrol downwards in the direction of the flow of mixture towards the opening ports in the cylinder.

The Camshaft, which is fitted at the small end of the crankshaft, turns at half the speed of the engine and in the same direction and is operated by the usual satellite pinions.

Lubrication is by means of the usual Gnome pump, and the oil-way system is similar to the 80 h.p. Gnome engine, except that there is a forced feed to the gudgeon pins.

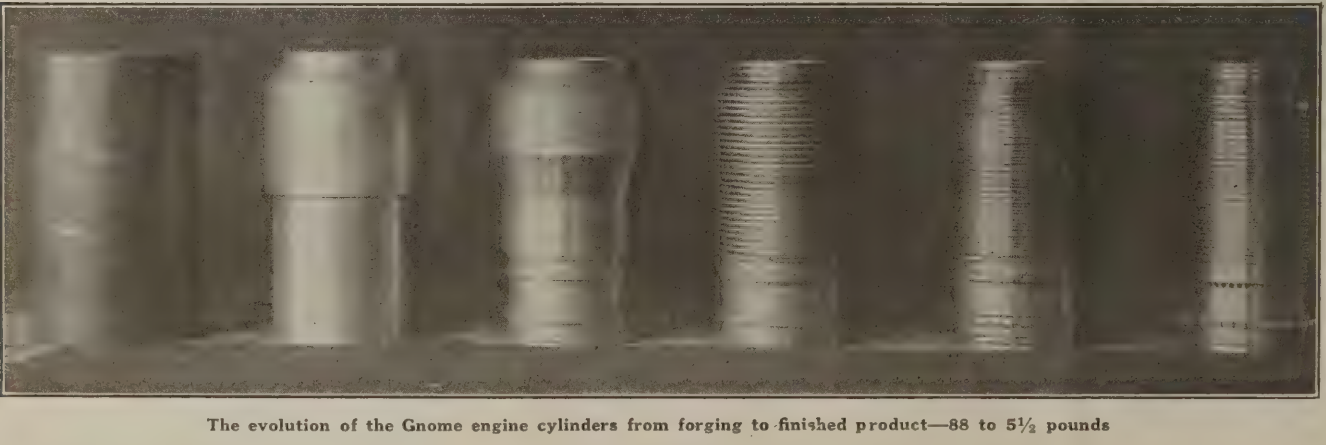
CYCLE OF OPERATIONS

The engine works on the four-stroke cycle. Consider a cylinder in which the piston is on the compression stroke and follow the engine through two revolutions.

(1) *Ignition*, which is "fixed," is set to take place 15° to 20° before the top dead center.

(2) *Working Stroke*—After ignition the piston descends on the working or power stroke, as shown by the arc B C (Fig. 2).

(3) *Exhaust Stroke*—When the cylinder has turned through 85° from the top center, the valve begins to open, and exhaust of the products of combustion commences (Fig. 2, C). The exhaust stroke continues until the piston returns



The evolution of the Gnome engine cylinders from forging to finished product—88 to 5½ pounds

(Continued from page 257)

pin without sacrificing necessary bearing area, were solved by the use of a master rod, in which construction one rod has a sleeve around the whole crank-pin, as is usual with single cylinder engines, and the other four rods bear on the outside of this sleeve. In this way the small bearings between the four rods and the master rod receive none of the rubbing effect due to the rotation of the crank-pin, except that of slipping a very short distance over the sleeve during each revolution, on account of the angularity of the rods. This construction was successful from the start and is now used in a slightly modified form in nearly all radial and revolving engines.

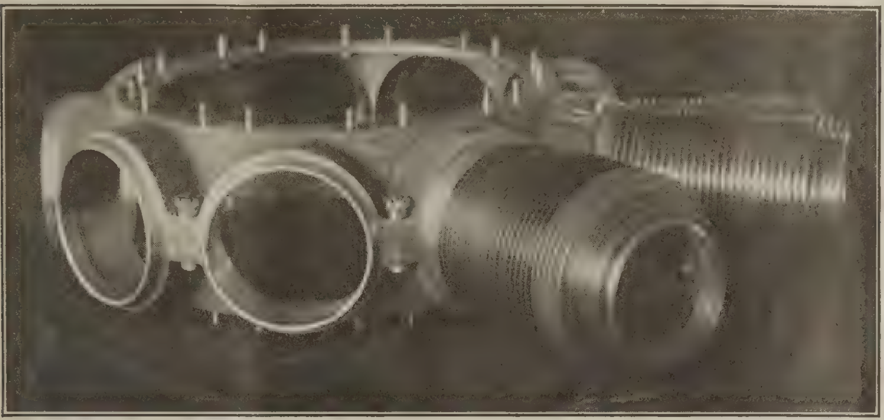
In order to get a reliable and equally hot spark in each cylinder, the scheme was originated of using one spark coil and vibrator for all cylinders, with a distributor to select the correct cylinder for each spark. All procurable spark plugs were very unreliable because of the frequency with which they became short-circuited with carbon, and to correct this the plug shown in this drawing was made. The pocket around the points which is now known to be so valuable, eliminated all this trouble.

As may be seen, the intake valves are automatic, and the exhaust valves are operated from a central cam. This cam, which has two points 180° apart, rotates at one-quarter engine-speed in the opposite direction. The light weight of the whole valve mechanism is noteworthy. As all parts were lubricated by oil cups, very little unnecessary oil was used, giving a consumption which is superior to what is usually required by such engines.

This engine, which was completed in December, 1901, was given three ten-hour runs while connected up to water dynamometers and showed a performance which is not often surpassed even to-day. At 950 r.p m. 52.4 horsepower was delivered, giving a weight of but 2.37 pounds per horsepower, based on the stripped weight of the engine, which is 124 pounds. The complete engine, including balance weights, ignition coil and batteries, carbureter, radiator, water and gasoline tanks and all other accessories, and with radiator, water tank and jackets filled with water, is only 3.65 pounds per horsepower. This is about on pound per horsepower lighter than present day water-cooled engines.

Thus two Americans succeeded in producing the first man-carrying aeroplane which could support its own weight in stable flight; Samuel Langley produced the aeroplane, and Charles Manly produced the power plant. Those of us who blush with shame because our government possessed less than fifty military aeroplanes at the outbreak of the European war, while European countries were making daily use of tens of thousands, will do well to realize that this first successful aeroplane was developed by the support of our own military authorities long before other governments did as much, and that if it had not been for the ridicule of a hostile press, and the sneers of a self-satisfied public, our government would have been the first to have possessed practical military aeroplanes.

(To be continued)

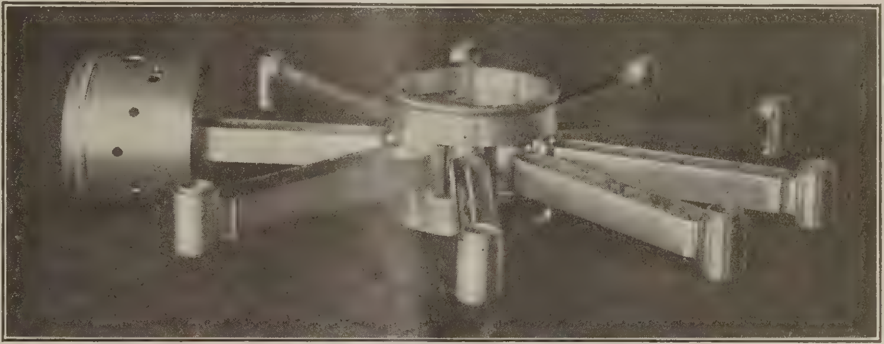


The two-piece crank case, showing the manner in which the cylinders are held in position

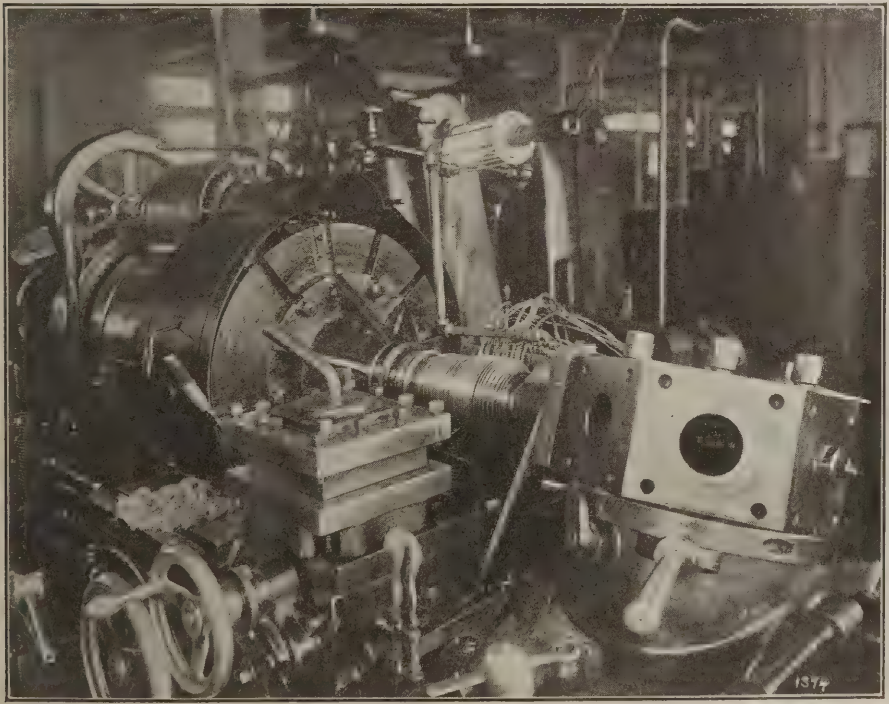
to the top dead center, as shown by the arc C D E F.

(4) *Induction Stroke*—The valve still remaining open, the piston descends on the induction stroke, drawing air into the cylinder through the valve. 65° before the bottom center the valve closes (H, Fig. 2). On the piston continuing to descend, a partial vacuum is created in the cylinder until it is 20° from the bottom center (I, Fig. 2).

At this point the piston uncovers the ports in the cylinder wall, making connection between the cylinder and the crankcase, and a very rich petrol mixture is drawn into the cylinder. This rich mixture is diluted by the air already in the cylinder, and the resulting mixture in the cylinder is a good combustible gas.



The arrangement of the "mother" rod and the other rods on the hub



One of the thirty operations in the turning of the cylinders; cutting the fins on a heavy-duty lathe

The ports in the cylinder will remain uncovered until the piston reaches the point J (Fig. 2) on the return stroke.

(5) *Compression Stroke*—On the closing of the ports the piston ascends on the compression stroke J (Fig. 2), and when 20° from the top center (L, Fig. 2) ignition occurs, and the cycle of operations is repeated.

Note—The timing diagram given in Fig. 2 is an average from a number of tests. It is found that engines vary slightly, and each engine is supplied with a special set of timing figures which should be used and adhered to.

(Continued from page 259)

down by Russian motor-guns on Jan. 26th, 1915 while raiding Libava. The crew of seven were made prisoners.

No definite information is available regarding the number of airships turned out during the war; it has been reported that the L. F. G. works of Bitterfeld have been turned into a repair station for Zeppelin airships and that the output of Parsenal airships has consequently been greatly limited.

FOREIGN NEWS

FRANCE

The official report for April 26 is as follows:

"April 23 and 24 six German aeroplanes were brought down in aerial engagements by our pilots. In addition sixteen were seen falling into their own lines, seriously damaged.

"From the 16th to the 22nd our pilots added appreciably to the number of their exploits. Sub-Lieut. Dorne brought down his nineteenth and twentieth machines; Sub-Lieut. Geuillin his fourteenth; Lieut. Pinsart his ninth and tenth; Sub-Lieut. Tarascon his tenth; Sub-Lieut. Languedoc his sixth and seventh, and finally, Adjutant Lufbery (Raoul Givas Lufbery of the American Squadron) accounted for eight machines up to that day."

Paris, April 29.—American aviators again have emerged victorious from a battle in the clouds with German airmen, it was learned here to-day. The heroes of the encounter were Willis Haviland of Minneapolis and Charles C. Johnson of St. Louis, who are under the command of Lieut. William Thaw.

Flying together in separate machines, the two Americans encountered a group of German aeroplanes. Haviland forced one enemy craft to an altitude of 4,000 feet, where he engaged it in combat. After a spirited fight the German machine, riddled by machine gun fire, collapsed and fell.

Almost at the same time Johnson had a desperate battle with another German machine, which he put to flight, evidently in distress. Its fate was not determined. Several other German aircraft refused battle and escaped.

The *Matin* says news has been received at British headquarters that Lieut. William Leefe Robinson, the aviator who destroyed a Zeppelin, is not dead but a prisoner in Germany. Lieut Robinson's gasoline ran out and he was obliged to land within the German lines.

A German official statement received in London April 13 said Lieut. Robinson's machine was shot down on April 5 by a German battle aeroplane. Lieut. Robinson won the Victoria Cross by bringing down a Zeppelin during a raid on London last fall. It was the first feat of the kind to be performed in the war.

GERMANY

A recently captured report of Gen. von Buelow on the experiences of the German First Army has instructive passages, especially where he dwells upon British superiority in the air, how airmen attack the German infantry in their trenches with bombs and machine guns. He adds:

"Even though the losses thus caused are comparatively small, the occurrences have an extremely lowering effect upon the morale of our troops, who at first were helpless. The innumerable balloons, hanging like grapes in clusters over the enemy lines, produced a similar effect, for individual men and machine guns could be picked up by them, watched and subjected to fire."

German seaplanes on April 26 successfully bombed the harbor works at Sulina (in Roumania, on the Black Sea, at the mouth of the Danube, near the Russian border). Large fires broke out in the harbor works and on barges. All the seaplanes returned safely in spite of the vigorous firing of anti-aircraft guns.

The destruction of a Zeppelin of the latest type is reported in an Amsterdam dispatch to the Exchange Telegraph Company. It is said Prussian deserters who have reached Maestricht, Netherlands, told of the loss of the airship, which was destroyed in a storm when east of Duisburg, Rhenish Prussia, on a trial trip between Friedrichshafen and Wilhelmshaven last Monday. The airship was overturned by the gale and exploded, causing the death of the entire crew and two officials from the Zeppelin plant.

GREAT BRITAIN

London, April 24.—A British Admiralty statement reports an attack by three British naval air machines on five enemy destroyers which were sighted on April 23, steaming between Blankenberghe and Zeebrugge in a northeasterly direction five miles off the coast.

"The leading machine," says the statement, "attacked, dropping sixteen bombs, one of which was seen to obtain a direct hit. The remaining four destroyers scattered and were attacked by the two remaining machines, thirty-two bombs being dropped. The leading destroyer was observed to take a list to port and remained stationary after all the bombs had been dropped.

"The four destroyers closed in on the disabled craft. A hostile seaplane attacked our machines, but was easily driven off. At 6:10 P. M. the four destroyers were reported by a reconnaisance machine as entering Zeebrugge Harbor. It is considered most probable that one destroyer was sunk."

Announcement was made in the House of Commons on April 26 by Major John L. Baird, representative in the House of the Aerial Advisory Board, that the Government had decided to appoint a committee under the chairmanship of Lord Northcliffe to investigate civil aerial transport after the war. This, he said, would permit of the employment of the large number of skilled pilots and the aeroplanes in the hands of the army and navy, and the still vaster number of machines the construction of which is under way or planned. Although Major Baird did not disclose the exact figures, he showed that the output of aeroplanes had been increased greatly during the last few months and that an even greater increase was expected. Taking the monthly average output for the last year as the imaginary figure of eight, he said, the output for the first two months of this year would be represented by sixteen, and it was expected that by the end of the year it would be represented by thirty-eight.

The exploits of the Allied aviators during the past week have excelled in intensity and results all previous manœuvers. To tell the entire story would require pages, but we will take one day—April 24—as an example. The report follows:

With the British Armies in France, April 24.—The intensely bitter ground fighting of the last two days has been reflected in the air, and the British Royal Flying Corps yesterday established a new record by bringing down forty German machines. Fifteen of these were actually seen to crash, while twenty-five collapsed or fell in spinning nose dives, completely out of control.

The fights took place 15,000 feet in the air, from which distance it is barely possible to see the ground and wholly impossible to see an adversary crash unless the pilot deliberately follows down. Such a course is not feasible where the fighting has taken on the character of a general melee, as is nowadays often the case. A remarkable part of yesterday's performance is that only two British machines are missing.

It was the finest day for war flying that the young khaki pilots ever had, and to-day they have been at it again since sunrise, but the full reports of their exploits are not yet in. It is known, however, that one intrepid young flyer, failing to find a single German observation balloon aloft, sought out one in its hangar on the ground, dived at it and set the big gas bag ablaze from stem to stern.

Since Sunday the British airmen have been revelling in weather they have long desired. Not a cloud was in the sky to-day behind which a German could find shelter. Deprived of that means of "digging themselves in," the German flyers were far scarcer than usual and very difficult to find. British machines were everywhere along the battle-front and far behind the German lines. Bombing raids were carried out forty-five miles back, the machines deliberately flying over ground where battles were raging with the greatest fury.

German trains rushing reinforcements to the front were attacked and transport columns on the roads were bombed and completely disorganized. In several instances the British went low over the fighting lines and poured machine gun fire into the German ranks. In doing this machines have deliberately crossed the fire of their own as well as the enemy's guns.

Yesterday one British pilot, after bringing down two Germans and exhausting his ammunition, descended, reloaded, filled up his petrol tanks and took to the air again. Within half an hour he had brought down his third machine for that day. Another pilot felled two machines, while the other thirty-five were divided among a similar number of British pilots.

The greatest fight yesterday, oddly enough, was a drawn battle. One of the British pilots met a brilliant German flyer, and for a full hour they manœvered in a most marvelous manner, without either being able to bring his gun to bear on the other. They rolled, looped, twisted, deliberately stalled their engines, and, standing the machines on their tails, slid backward through the air; but all to no avail. It was probably the most wonderful air duel the war has yet seen.

The British pilot reported to-day that several times he felt sure he would get his adversary between his sights, but the latter invariably wriggled out of the line of fire. The British flyer himself was kept busy avoiding the German, and once he had to dive almost perpendicularly. The combat did not break off until both pilots had fairly exhausted themselves and their petrol.

Strangely enough, later in the day another British pilot encountered the same German machine. The Britisher was winging his way home after a hard day's work, but he jockeyed with the German for nearly a quarter of an hour before flying on.

In strange contrast to this was the experience of one British pilot, who somewhat peevishly complained last night that "I only got a 'rabbit.'" He explained this by saying that, while his opponent had a good machine, he was a clumsy fellow and couldn't fight at all, and was sent spinning with the first burst of gunfire.

Still another pilot mounted a fast, new machine and deliberately allowed a German to get on his trail. Then he suddenly looped behind his adversary and caught him just within the sights, the burst of fire killing the German instantly. The machine swerved and the dead man pitched out ten thousand feet from the ground.

The fighting yesterday was all within the enemy territory. Several British machines had bullet holes through their wings, but sailed home unaided and took the air again this morning.

ITALY

Udine, Italy, April 28.—Several thousand copies of President Wilson's war message, translated into the different languages of the Austro-Hungarian monarchy, have been dropped by Italian aviators in Austrian territory.

JAPAN

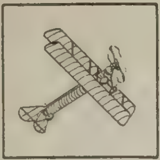
Japan has lost another promising young army airman by the death of Lieutenant Sugino. Previous to his return journey from Shimoshizu, Lieutenant Sugino discovered some flaw in his machine, so delayed his start for Tokorozawa. Eventually he commenced what proved his last flight at 10:40 A. M. About 11:25, when the machine was over Okumura, Toyoshimagori, it was seen to turn over two or three times and then crash to the ground.

An employe of the Inawashiro Water Power Company was an eyewitness of the catastrophe, and hastened to the scene. Lieutenant Sugino was found pinned beneath the wreckage of the machine. The unfortunate officer was immediately removed to a house close by and made as comfortable as possible, but he lived but a short time.

On learning of the accident, officers of the Flying Corps at Tokorozawa, including Commander Narutaki and Captain Tokugawa, hastened to the scene by motor-car, but arrived after Lieutenant Sugino had breathed his last.

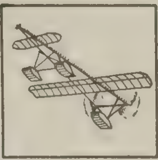
The northeast wind is alleged to have been responsible for the accident, breaking the right wing of the machine. The propeller then came into collision with the loose end of the wing and tore the machine to pieces. The late officer was about to take an examination to enter the army university, and was to try to obtain his certificate for flying in a few weeks' time.

Lieutenant Sugino, who was twenty-seven years old, was born in Kanazawa, and it is told that by the death of the lieutenant the city of Kanazawa has lost three military aviators hailing from there. H.I.M. the Emperor, upon the news of his death, dispatched an Imperial messenger to express sympathy, and H.I.H. the Crown Prince also sent a representative. The monetary gift was conferred on the family of the aviator by the Emperor and the Crown Prince. The Emperor also granted him posthumous honors, which decorated the deceased with the Fifth Order of Rising Sun with double rays.



MODEL NEWS

Edited by G. A. Cavanagh



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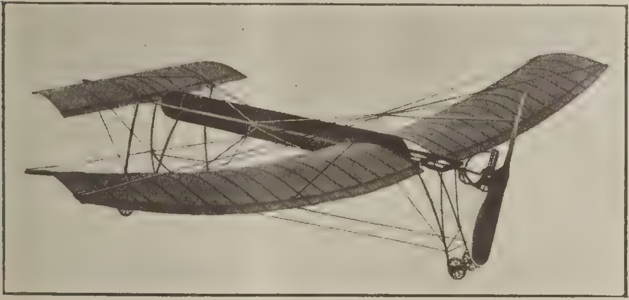
Compressed Air Driven Model

The development of the compressed air engine has given an added impetus to model making, necessitating more scientific experimenting and developing the act of model flying along lines of greater value to those who may eventually take up the work of building our future air fleets.

In the accompanying illustration is shown a model aeroplane of monoplane type driven by a three-cylinder rotary engine which was constructed by Edward Willard Dart of South Norwalk, Connecticut.

The engine was constructed after several months of patient labor. Careful judgment was exercised in the drafting of the plane and likewise in the assembling of the engine for it is absolutely essential that all parts be properly fitted as to enable the engine to run smoothly. In designing the wings every detail was taken into consideration to insure good flying.

The main wing has a spread of 58 inches and 7 inches in chord. The elevator measures 23 inches in spread by 6 inches in chord. In the construction of both wings bamboo ribs are used the frames being covered over with China silk and coated with Celluloid solution. The main wing is made in two sections to facilitate quick adjustment to the fusilage.



Model by Edward Willard Dart

Paper Models

Mr. H. Major writes as follows concerning paper models:

"I am sending scale drawing of a small paper monoplane, which I have found to give excellent results. The scale given only applies to diagrams illustrating wing construction, side elevation and plan view.

"Materials to be obtained before commencing are:—

"1. A few sheets of hard bank paper; if this not to hand, fairly stout notepaper may be used.

"2. A small piece of thin tinned sheet iron.

"3. A short length of iron wire of about 26 S.W.G.; a thin hairpin will serve the purpose.

"4. A piece of wood 8 ins. by 1/6 in. by 1/10 in., to form the backbone, and another 5 ins. by 2/5 in. by 3/10 in., for the screw.

"6. A few small glass beads, the smallest procurable.

"7. A thread or so of silk; a tube of liquid glue; 10 ins. of 3/16 in. elastic; scissors, &c.

"Take the wood intended for the backbone, and taper slightly towards each end, leaving a full section in the center. The rubber hook should be fitted at one end, as illustration C and C1, in such a manner that it will allow the rubber to run along the thickness of the wood (not the width). The piece of tin should then be taken and drilled, so as to allow the wire to just pass through the hole.

"The metal may now be cut with the scissors to the shape B, and bent at the dotted lines as in B1, this bearing to be fitted to the opposite end of the backbone, and the flaps folded over as B2. A thin piece of cane, 4 ins. long, should be taken and bound to the backbone at C, in the manner shown in C1. This is set at a slight upward angle, and is to carry the tail.

"The tractor screw may now be carved. Mark the wood in the center of its length and width, and bore a hole with a needle through the thickness. Carve the propeller so that the angle of its blades diminishes towards the tips. Sandpaper till almost as thin as paper and coat with liquid glue. This will soak in and dry with a rough surface, so continue coating with glue, until a varnished effect is obtained. A screw treated in this manner will very rarely break, and when thoroughly dry, is not rendered sticky by the heat from the fingers. Pass a piece of wire 2¼ ins. long through the hole in the boss, and bend over at the end as B2. Place two beads on the shaft, and bend same at the other end into a hook for the rubber.

(To be continued)

Kites

The official Gazette reports the following kite patent which has been allowed and for the information of our kite friends the report is herewith printed in full:

1,223,163. KITE. Andrew Lang Graham, Santa Rosa, Cal. Filed Dec. 14, 1916. Serial No. 136,956. (Cl. 244—23.)

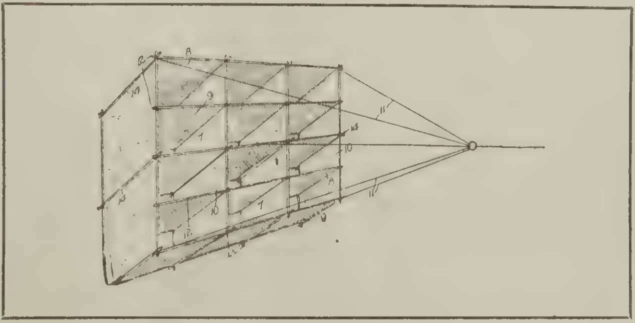
1. A kite comprising a cell having a rectangular-shaped opening in the front and rear thereof and presenting rectangular-shaped top and bottom planes and parallelogram-shaped side planes, said side planes being so related to the top planes that the free front edge of said top plane overhangs the free front edge of the bottom plane in the projection of said top plane on the bottom plane.

2. In a multicellular kite, a plurality of coplanar cells each presenting a substantially rectangular-shaped front and rear opening, each of said cells having substantially rectangular-shaped top and bottom planes and substantially parallelogram-shaped side planes.

3. In a kite, a plurality of cells, each cell presenting a front and rear opening, the top and bottom planes of each cell being in the shape of a rectangle, the side planes of the cell being in the shape of a parallelogram, the front and rear of said cells lying in respectively common planes.

4. In a kite, a plurality of coplanar cells open in the front and rear thereof, each cell presenting rectangularly-shaped top and bottom planes, and parallelogram-shaped side planes, said side planes being so related to the top and bottom planes that the front edge of the top plane overhangs the front edge of the bottom plane and the rear edge of the bottom plane extends beyond the rear edge of the top plane.

5. In a kite, a plurality of coplanar cells open in the front and rear thereof, each cell presenting a rectangular-shaped top and bottom planes and parallelogram-shaped side planes, transverse and vertical bars reinforcing said cells at the front and rear, brace members connecting said bars, and bridle strings connected to said brace members at predetermined points of the kite, substantially as and for the purpose set forth.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Newark, Feb. 8.

Dear K. C. B.—We have a hydroaeroplane over here in Newark that spreads its wings 73 feet. We want you to come over and make a flight with one of our aviators, and we can assure you that the pleasure of having you over will only be exceeded by the exhilaration of your flight. If you will come, will you kindly let us know when to expect you?

N. Y. AERO CONSTRUCTION CO.,
Henry Frauenthal, Secretary.

LISTEN, HENRY.
* * *
ONE TIME before.
* * *
OUT IN the West.
* * *
I PROMISED a fellow.
* * *
I'D GO for a ride.
* * *
IN AN aeroplane.
* * *
AND I got in.
* * *
IN FRONT of a lot of people.
* * *
AND THEY tied me there.
* * *
WITH STRAPS.
* * *
AND I was scared to death.
* * *
AND THE aviator.
* * *
HE GOT in his seat.
* * *
AND THEY tried to start it.
* * *
AND THEY couldn't.
* * *
IT WOULDN'T work.
* * *
AND THEY unstrapped me.
* * *
AND LET me out.
* * *
AND I'VE always figured.
* * *
IT WAS the Lord.
* * *
THAT FIXED the engine.
* * *
SO IT wouldn't go.
* * *
HE WANTED to save me.
* * *
FOR SOMETHING else.
* * *
NOT SO violent.
* * *
AND ANYWAY.
* * *
ALL YOU ask me to do.
* * *
IS TO make a flight.
* * *
AND YOU don't say anything.

ABOUT LANDING.
* * *
AND FROM what I've seen.
* * *
IT'S THE landing.
* * *
THAT COUNTS the most.
* * *
IF I wanted.
* * *
TO MAKE a flight.
* * *
I COULD do it.
* * *
WITHOUT ANY aeroplane.
* * *
OR ANYTHING.
* * *
I COULD go to the tower.
* * *
OF THE Woolworth building.
* * *
OR THE Brooklyn Bridge.
* * *
OR ANYWHERE.
* * *
AND JUMP off.
* * *
IT ISN'T the flying.
* * *
THAT SCARES me.
* * *
IT'S THE looking down.
* * *
AND WONDERING.
* * *
AND AT this time of the year.
* * *
IT'S SO much worse.
* * *
THAN THE Summer.
* * *
THE GROUND'S frozen.
* * *
AND IT doesn't give.
* * *
AND I don't want you to think.
* * *
THAT I'M a coward.
* * *
BECAUSE I'M not.
* * *
BUT I like to be.
* * *
WHERE I can run.

IF I have to.
* * *
AND THE way I'm built.
* * *
I CAN'T run.
* * *
UNLESS MY feet.
* * *
ARE ON the ground.

AND I thank you.
* * *
FOR YOUR invitation.
* * *
BUT I can't go.
* * *
MY WIFE won't let me.
* * *
I THANK you.

—Courtesy N. Y. Journal.

Explaining It to Him

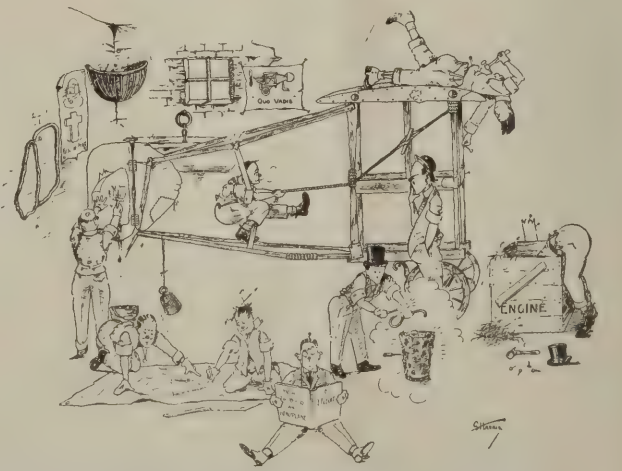
They were standing together in front of the aeroplane. It was evident that one of them knew all about such machines, while the other wouldn't have been able to describe one of them if it had driven up to him upon horseback.

Removing a sign from the machine which said, "Please do not lean on wings," one of the men, with an ease worthy of special commendation, placed his elbow on the center of the highly varnished wing surface, and began to talk.

"Yes, sir," he said, "I know all about these machines. This one here is a tractor biplane. Why a tractor? Why that is because they use one of those farm tractor engines in it. You see those three wings? Well, that's why it is called a biplane, for, as you may know, the word *bi* is from the Spanish, and means *three.* You see this feller Zeppelin, that invented the aeroplane, was a Spaniard, and as he spoke Spanish they naturally followed his wording."

He then stood off from the machine a few feet and gazed at it admiringly. "You see that long body, that goes straight back? That's where they keep the gas. These things can't fly without gas. How does it go up and down? Very simple! You see, when they want to go up they point the thing up in the air, and it just goes up. To come down, they let the gas out and it just naturally comes down. How do they steer them? Lissen, I'll explain. You see those wheels underneath? Well, when they want to turn, they simply turn the wheels the way they want to go, and the whole machine turns with the wheels. Could anything be more simple?"

His friend looked at him in open-mouthed wonder and admiration, and they left.



Scenes in an Aircraft Factory, Ill. Before the war—when it may be noted, the experimenters were gentlemen, as the top hats will witness, or lunatics (vide the designer).
—Courtsy of AEROPLANE.

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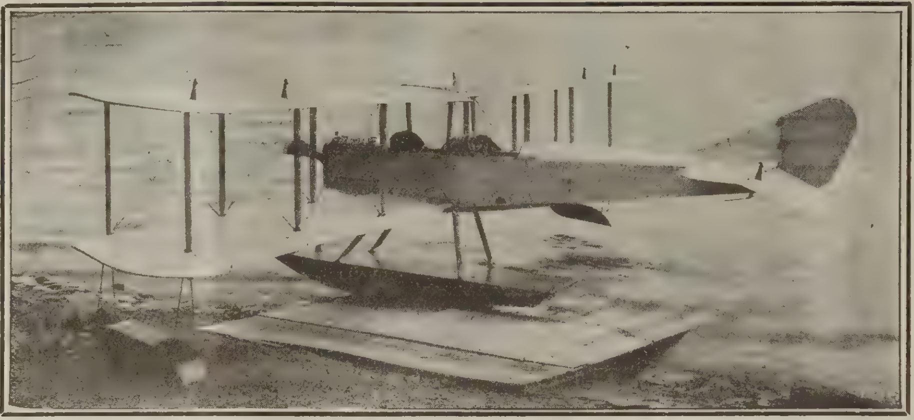

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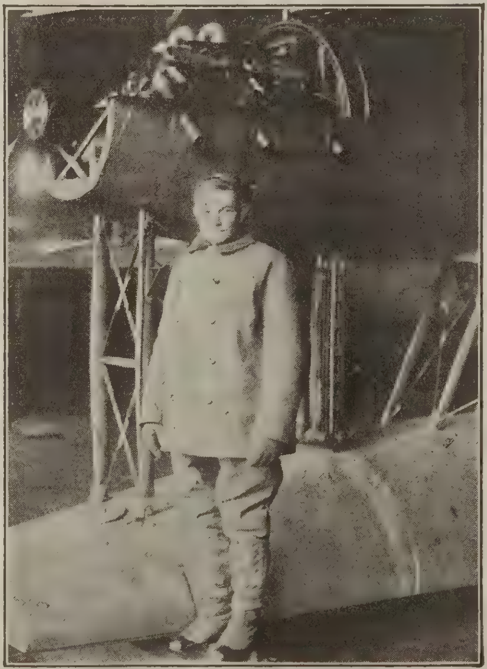

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C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

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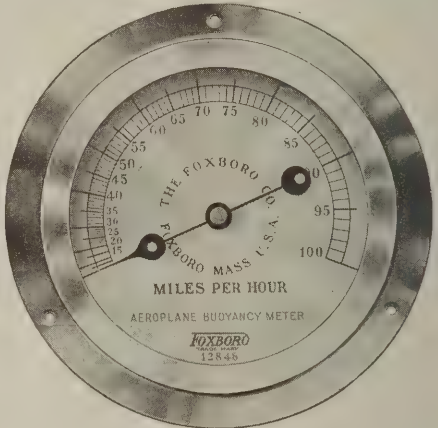

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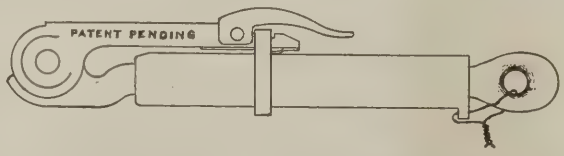
The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

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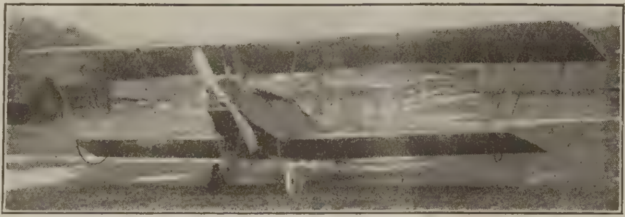

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AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

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The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

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extensive organization and administrative force. We have been attempting for over a year to do within a few months what should have been done during the past ten years, with a few men. The overburdened Signal Corps in the Army and the Bureau of Operations in the Navy have been trying to attend to the development of aeronautics besides doing their other duties. As a matter of fact, their other duties require more than all of their efforts and all of the time and efforts of a staff many times that of the present one. So we must extend our administrative organizations, and I therefore urge that the time is ripe to establish an independent department of aeronautics, which shall coordinate and develop the aeronautic resources of the Army, the Navy, the Coast Guard, the Post Office, and so forth, and also the civilian developments, including aerial transportation, which is bound to come in the very near future.

In establishing a department of aeronautics, with a secretary of aeronautics, who will be a member of the Cabinet, we shall only follow the example of European countries. Great Britain and France, after trying every means and way, finally had to come to the conclusion that a separate department of aeronautics, with a Secretary of the Air as a member of the Cabinet, was the only solution to the problem. Surely we Americans, who are known to be practical people, will not fail to learn by the experience of these other countries, which are now our allies.

There is now a bill before the Congress, known as the Sheppard-Hulbert Bill, providing for the creation of a department of aeronautics, with a secretary having a portfolio in the President's Cabinet, upon which I hope Congress will act favorably at this session.

How We Can Hit Hard and Fast

(*Editorial in the New York Globe*)

What we can do in air fighting is described in the news columns of this issue. We can hit Germany hard and we can hit her soon. We can establish for our allies complete mastery of reconnaissance and artillery direction. In other words, we can win and hold control of all operations overhead, thereby depriving our enemy of what is vital in modern battles. We can even hope, if we buckle down to the job, to deal German armies a fatal blow by seriously interfering with, if not destroying, their lines of communication.

Destitute though we now are of war planes, there is no reason to doubt that within a comparatively short time our factories can build in large numbers duplicates of the best models of the French and British machines. As it is our allies have been able frequently to assert their superiority in the air on the western front. With the machines we can add this superiority can be made overwhelming and permanent.

As for the crews, our young men will come forward as soon as a call for them is out. We have at least two hundred competent fliers ready to take first shipments abroad. Others can be mustered in and taught the rudiments of aviation while our manufacturers are busy. In the French aviation fields the American corps can be fitted for whatever military service is desirable.

Here is a chance to take part quickly and decisively. It accords with the spirit of the nation that is impatient of needless delay and mere onlooking. If the suggestion meets the approval of the military authorities no time should be lost in getting to work. What America can do to end the war right and soon she wants to do with all her might.

Our Aeroplanes Equal to the Best

(*Editorial in the Jersey City Journal*)

It is not true, as charged by travelers who have returned from the war zones, that Europe has far outstripped the United States in the development and manufacture of the aeroplane, America's own invention. In a report just filed with the Aero Club of America by its Advisory Committee on

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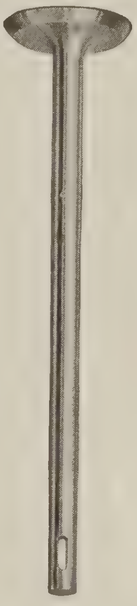

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Aeronautics, a group of distinguished scientists and others who are co-operating with Rear-Admiral Usher in the organization of the Naval Reserve, it is made plain that the American aeroplane is the equal of anything Europe, under the spur of war necessity, has produced. Included on the committee are such men as Rear-Admiral Bradley A. Fiske, retired, Rear-Admiral Robert E. Peary and John Hays Hammond, Jr.

The report sharply asserts that, type for type, the American aeroplane is fully the equal of the European; that our seaplanes are the superior of any; that our speed machines, while attaining 130 miles an hour, against 140 by the crack European makes, discount this small advantage of speed by being 50 per cent safer. Europe's only present complaint against our aeroplanes is that we do not make enough of them.

An investigation of statements of people who on their arrival in this country from Europe have asserted that American aeroplanes are not used at the front in Europe has brought out the fact that the aeroplanes ordered in this country so far, with the exception of our large seaplanes, which are superior to any European product, have been only the training type.

The reason why only the training type of aeroplanes have been ordered in this country by the Allies is that the limited production in this country in the last two years did not permit deliveries of thousands of aeroplanes, and it would have been most inefficient to send to the front a few hundred aeroplanes of a type for which spare parts were not available. This inability on the part of American constructors to deliver aeroplanes by the thousand at the time when the Allies needed them most made it necessary for the different countries to create their own sources of supplies for the bulk of the machines needed by them.

Statements made to the effect that the American fighting aeroplanes do not have the speed and climbing ability of foreign fighting machines are based on the fact that in America we demand a factor of safety of six, whereas foreign machines have a factor of safety of only three. Likewise, where foreign countries accept machines that land at a speed of close to 100 miles an hour, in the United States we expect our fast aeroplanes to land at a speed not exceeding sixty miles an hour.

Considering that we have a factor of safety twice as large as the foreign machines, and that we have a landing speed not exceeding sixty miles an hour, our fighting machines compare favorably with the foreign machines in speed. We get a speed of approximately 130 miles from our machines, while the European machines, with the lower factor of safety and greater landing speed, get only about ten miles more.

America to the German People

LIBERTY BELL

By George Morrison von Schrader

(Mr. A. B. Lambert, president of the Aeronautical Society of Missouri, in transmitting this forceful poem to AERIAL AGE, *through Mr. Alan R. Hawley, suggests that it would be a good idea to translate it into German and have it dropped over the German lines by the Allied aviators.)*

I

Awake, Awake!
For ages you have slept.
Awake, Awake!
The glorious hour now dawns.
Awake, Awake!
Sand up where once you crept.
Awake, Awake!
Refuse to be but pawns.
Rise to your might, be brave and then
Throw down the gauntlet, act as men.

II

Awake, Awake!
Mistake not friends for foes.
Awake, Awake!
Ope wide and clear your eyes.
Awake, Awake!
Then know the author of your woes,
The culprit of your tears and sighs.

III

Learn 'tis not he with whom your swords are crossed;
His purpose lies alone in setting free.
Quick grasp the outstretched hand before 'tis lost,
That beckons on to glorious liberty.
Arise! Cease cringing to your noble's rod,
Demand your heritage, freedon! bestowed by God.
Awake, Awake, Awake!
Throw off your chains, be men.

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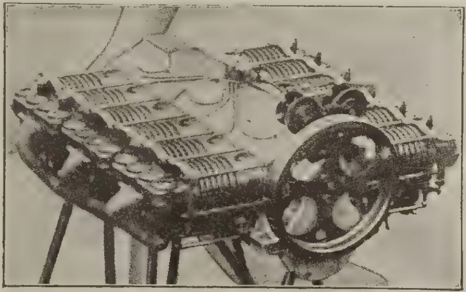

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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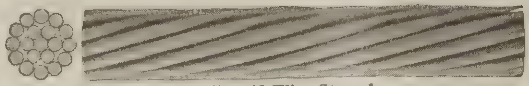

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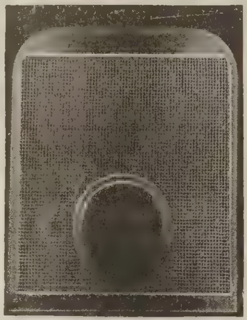

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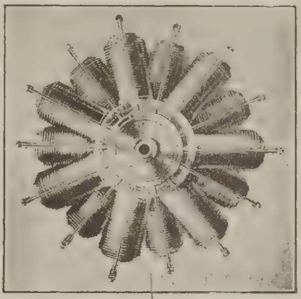

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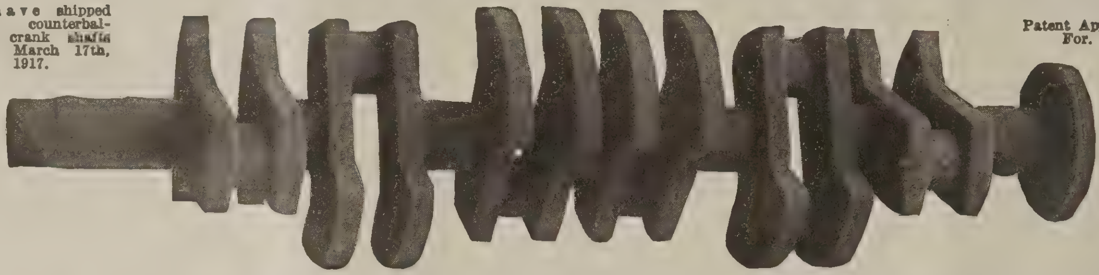

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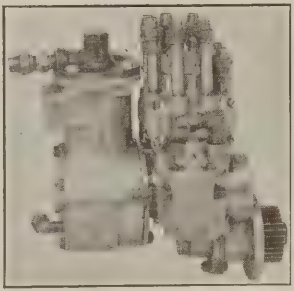

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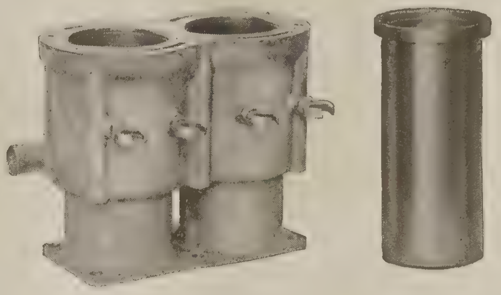

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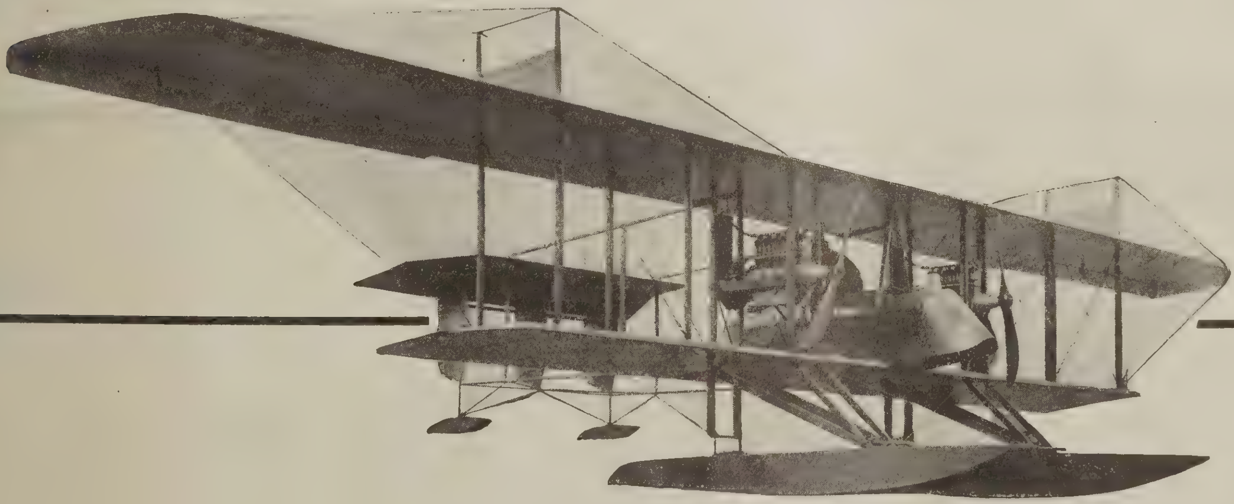

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MAY 15 1917

Victor Carlstrom Looping in the Baby Curtiss Triplane

English Press and Parliament Discuss America's Aeronautical Co-operation

The Gallaudet Navy Seaplane Described

AVIATION TRAINING

THE CURTISS School of Aviation will give training this winter, in Florida, to those civilians who may be accepted by the Aviation Section, U. S. A., upon their having made application for enlistment in the Aviation Reserve Corps. Applicants must be between twenty-one and twenty-seven years of age, possess good health, character and college education or equivalent. Tuition will be paid by the Government.

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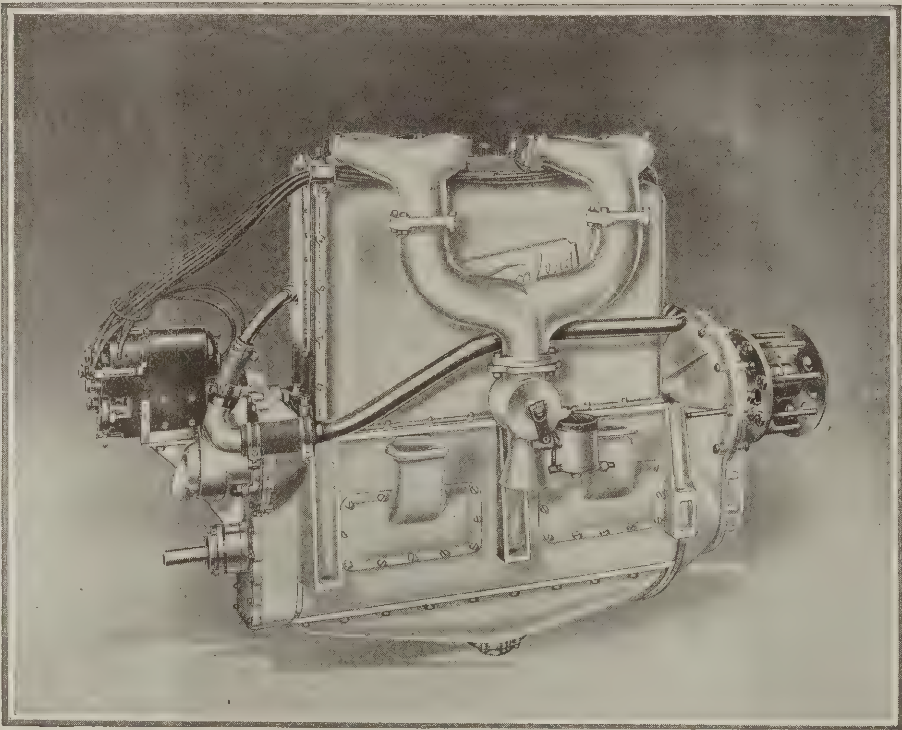

The Four Cylinder, Sixteen Valve

125 Horsepower

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THE Duesenberg Motors hold a dominant position in the field of racing automobiles, where more than 60 per cent of all cars racing on American Motor Speedways are Duesenberg powered. The same condition exists in the motor boat field, where Duesenberg engines have created new records for both speed and dependability. The first mile-a-minute boat in the world—Disturber IV—is powered with a pair of twelve-cylinder, 6¾" x 7½" Duesenbergs. The Displacement Runabout, "Marycel," that made a world's record at the recent Miami Regatta, is powered with an eight cylinder, 6¾" x 7¾" Duesenberg. Many of the Patrol Boats now in the service of the United States Government and also in the service of several of the Allied Governments are Duesenberg powered.

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SUGGESTION THAT AMERICA SEND 5000 AVIATORS TO EUROPE DISCUSSED IN THE HOUSE OF COMMONS —CORDIALLY ENDORSED BY THE BRITISH AERONAUTICAL PRESS

THE suggestion that America should co-operate with her Allies by concentrating on the construction and commission of a great air service was discussed on the floor of the House of Commons on April 18th, and readers of Aerial Age who have followed the history of aeronautical development in England will appreciate the point of Mr. Lynch's remarks.

The discussion follows:

United States (Air Service)—Mr. Billing (by Private Notice) asked the Chancellor of the Exchequer whether he will appeal to the Government of the United States of America to concentrate immediately on the construction and commission of a great Air Service, and also whether this Government is prepared to supply the American Government with sample machines, engines, drawings and specifications of our latest and most successful types, and to render them every other possible assistance to this end.

Mr. Bonar Law: This subject is already under consideration with the Government of the United States.

Mr. Lynch: Would it not be wise to allow the Government of the United States to decide these questions for themselves on the ground that one of the great assets is an infusion of brains, which are badly needed?

Aeronautical Press Endorses Suggestion

THE proposition to send 5,000 aviators to Europe is spreading. In the current issue of *Flight,* a British aeronautical publication, the part that America may play in the great war, particularly as regards aviation, is described as follows:

"Although the United States is now an Allied nation, possessing almost unlimited potentialities for the assistance of the cause for which we have been fighting for nearly three years, it will still be many months before she can make the full weight of her military power felt on the battlefields of Europe. America is in very much the same position that we were at the beginning of the war. Her regular army is small, maintained only for police purposes, and she is faced with the problem, as we were, of creating an active service army of dimensions worthy of her status as a great power.

"She will accomplish it—as we did—but the process will naturally take time, and it must be many months before the first of the new American armies are ready to take the field against the enemy of civilization. In all probability it will not be before the beginning of 1918 that we shall see them definitely in the field. It is as well that we should realize this, in order that we may be under no misapprehension as to the magnitude of the task that lies before us. But if the full measure of the strength of the United States cannot be put forth at once, there are other things that she can do for the helping of the common cause. These we may depend upon it she will do to the utmost of her power.

"The first manifestation of American good will to help concerns us very closely. It is probable—practically certain—that the first contribution America will make to the fighting strength of the Allies, apart from the services of her magnificent navy, will take the shape of the despatch to Europe of a number of aeroplane squadrons. According to the news that reaches us by cable, a very strong movement is on foot to recruit 5,000 American aviators for immediate service in Europe. Interviewed on the subject by the New York correspondent, Mr. Woodhouse, a governor of the Aero Club of America and of the National Aerial Coast Patrol Commission, said:

"'I have sounded public opinion as to the sending of a large number of aviators to fight with the Allies, and I find general and enthusiastic approval of the plan. There will be no trouble to get 1,000 volunteers to make up American aero squadrons to be sent to Europe. I rather believe there will be many times more applications than are wanted. Students from about twenty universities, including Yale, Harvard, Columbia, Princeton, Cornell, Georgia and the Institute of Technology, are already forming units of the Aerial Coast Patrol, and we have 1,000 applications for aviation training on the file.

"'There will be no trouble whatever in getting the aeroplanes and equipment needed to train and equip these men. It would take about ninety days to establish camps and to give the students their preliminary training, including the theory of flight, aerial gunnery, etc. By that time our American aeroplane factories will be turning out aeroplanes by the hundred. Within six months they will be turning out aeroplanes by thousands. Everything depends upon the prompt action of the Government, reinforced by the general public.

"'With such facilities as we can provide, there is no reason why numerous squadrons, fully trained and completely equipped, should not leave New York within six months, ready for the service training which can only be given on the field of battle.'

"All the news goes to show that the idea is being taken up with the enthusiasm which might be expected in the country which gave practical birth to dynamic flight. While it does not, up to the time of writing, appear to have received the cachet of formal administrative approval, there is little doubt that this will be given, and in the meantime the work of recruiting aviators in anticipation is proceeding apace.

"We could not ask a more acceptable token of the determination of our newest ally to get on with the business of defeating the enemy than the fruition of this idea. Apart from the very great moral effect of seeing the flag of the United States early in the field, the material help that would be afforded to the Allies in the west by a really strong contingent of the American Air Service would be very great. While we have no dearth of recruits for our own flying services, and do not anticipate any, it is nevertheless true that the wastage is appallingly heavy, and will doubtless tend to become even heavier as the campaign approaches its decisive stages. Therefore, we want all we can get, and the American accession to the Allied air strength will be correspondingly welcome."

A CASE FOR THE SPEED SCOUT

The fact that we have in America fighting machines equal in efficiency to the best European machines, is epitomized in the following report of the Advisory Committee on Aeronautics, co-operating with the Commander of the Third Naval District.

Dealing with American speed machines, the report states: *"The fast, single-passenger fighting machine.* It is principally the fact that we have not had machines of this type in use that has created the impression that American machines are not as efficient as European machines. But the first demand for this machine in the United States came only a few months ago, and the first turned out show a speed of 122 miles an hour, with a slow landing speed of 55 miles; a climbing speed of 10,000 feet in ten minutes. And the factor of safety is up to between 5 and 6. Of late the Army and the Navy have both been planning to place orders for machines of this type, and half a dozen manufacturers are prepared to turn them out. The thing to be decided just now is whether the Army and the Navy are willing to adopt the foreign specifications and content themselves with fighting machines that have a factor of safety of two or three and carry two hours' fuel and land at a speed of close to 85 miles an hour. If they will content themselves with this, we feel certain that American manufacturers can turn out fighting aeroplanes that will make a speed of close to 135 miles an hour, which is the very best actual performance obtained abroad, and will have good flying qualities and fast climbing speeds.

"But this low factor of safety and extreme landing speed, while necessary when it actually comes to fighting enemy aviators, can be dispensed with at a cost of only about five to ten miles per hour in speed, so long as our aviators do not have to fight enemy aviators and thereby save considerable injuries to men and machines during the period of necessary training. Our Committee came to this conclusion after watching the succession of breakages of the fast British fighting machine which has been tested at Governor's Island during the past few weeks. This machine was so lightly constructed and landed at such great speed that there was breakage at most of its landings. Finally, two British officers, who brought it over, crated it away. The account of the death of Norman Prince, of the Lafayette Corps, tells that the machine he was flying landed at a speed of close to 100 miles an hour. The new Spad is almost as bad in so far as factor of safety and landing speed are concerned. These are machines to use in battle and American aviators will use them when they get there, but it would be wrong to say that they are better than the American fighting machines being turned out.

"Recently there were printed in New York and Washington criticisms of slowness of American machines, coupled with claims of speed of 150 miles an hour for a newly arrived Vickers battleplane. A few days later those who followed the tests of this 'battleplane' at Governor's Island, witnessed a succession of breakages, due to the light construction ond extreme landing speed of that machine. Again and again it was repaired, only to be damaged again on landing after a flight. The agents who brought it over finally put it away in despair. But even at that no claim was made of the machine having a speed of over 120 miles an hour, because it did not make it.

"This brings us to the claims of excessive speed. Our Committee has found that none of the reports of speeds of upwards of 130 miles an hour have been substantiated. Now, as it has been for the past ten years, we get reports of tremendous speeds attained, but find upon investigation that it is merely hearsay. In our official capacity we have had to consider hundreds of claims of records submitted for homologation, and usually found on actual measurement that the distance covered was much less than the distance claimed. The aviators usually based their figures on railroad distances, but did not allow for the fact that the aeroplane went in straight line, whereas the railroad had detours.

"Miss Ruth Law, on her return from Europe recently, told our Committee that the reports of performances of European machines, particularly the speed, were exaggerated, not intentionally, but as the result of general habit of talking about great speeds. She is only one of many who have brought this to the attention of the Committee."

Seaplanes for Cargo Ships

(Editorial in *N. Y. Sun*)

In two instances during the war submarines have been sunk by explosives dropped from aeroplanes. In September of last year the French submarine Faucault was destroyed by Austrian seaplanes in the Adriatic, and earlier in the war, on January 7, 1915, U-11, an Austrian submarine, was sent to the bottom by an enemy seaplane. These cases are well authenticated. It is well known that the aviator can in certain lights, and particularly in calm weather, detect a submarine beneath the surface of the sea, very much as a fishhawk, flying sometimes at one height and sometimes at another, according to the state of the atmosphere, can see its prey when not exposed.

The success of aviators in attacking submarines has been limited, in fact casual, but only because no systematic seaplane campaign has been made against enemy submarines. There is, of course, a difficulty inherent in expeditions from a land base, for the aviator may go too far out and become a victim of his own daring or carelessness. But this would not be the case if seaplanes operated from the decks of large ships, which is feasible, whether for naval purposes or to protect cargo carriers.

If the decks of big freighters were fitted with runways for the launching of seaplanes, two or more machines could be carried on each voyage. At sea in any but the worst weather, the seaplanes could scout in daylight hours looking for submarines and prepared to attack them with explosives. That they would be a valuable protection to cargo and munition ships will not be disputed. The trial should be made with the least possible delay. We are sure that it would prove a signal success. Thereafter no big freighter would sail without seaplanes and a squad of aviators.

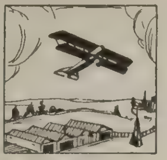
PLANS FOR AVIATION PERSONNEL

THE Chief Signal Officer of the Army, Brig. Gen. George O. Squier, has practically completed the program which it is expected will result in the securing of the hundreds of aviators necessary to bring the section up to the proper strength in the new forces authorized in the Administration Army Bill. Full details of the plan worked out in the office of General Squier cannot yet be made public, but the following outline will indicate the general idea:

Six universities have agreed to detail three or more instructors from their faculties, to be sent to Canada, where they will investigate the scholastic functions of the aviation school at Camp Borden. On their return these instructors will inaugurate a "preliminary course in aernouatics" at their several institutions which will give to the student in the briefest possible time the essential knowledge in that science. From the thousands of applicants for commissions as aviators, officers of the Signal Corps will select 100 from each university. They will be taken into the enlisted reserve of the Signal Corps and ordered to the college for the intensive course of study. Additional aviation schools along the plan of those at Mineola and Memphis will be prepared to give the student the actual flying experience and the finishing touches to his "education." Charles D. Walcott, chairman of the advisory committee on aeronautics of the Council of National Defense, has reported that, as a result of the co-operation of domestic manufacturers, there is absolute assurance that an adequate number of training machines will be available when the students are ready to use them.

The universities already included in the plan are Cornell, Ohio State, Texas State, Illinois State, Massachusetts Institute of Technology and California State. Representatives of these six institutions were in conference with General Squier April 30 and next day orders which will send the investigators to Canada were issued. In the Canadian school one month is allowed for the theoretical subjects and two for the instruction in the "squadrons." It is possible that this time may be cut in the case of the American students, who will be in every sense "picked" men. But should it be deemed best to maintain the Canadian schedule, an output of 200 embryo aviators per month after the end of July seems assured. It is more than likely, however, that the number of institutions will be increased.

The additional aviation schools to be established include one each near Detroit, Mich.; Champlain, Ill.; Indianapolis, Ind.; Dayton, Ohio, and St. Louis, Mo., and the permanent equipping of the schools near Chicago, Ill., and Memphis, Tenn. Major Benjamin D. Foulois, S. C., who accompanied Lieut. Col. J. B. Bennet to Canada last week, has been ordered to make a thorough inspection of the grounds available at each of these places and to report the result as soon as possible. The ten aviation fields between Columbus and Dayton, Ohio, equipped and owned by a prominent aircraft company in the latter city, may be used by the students at Ohio State University. As a general thing it is intended that the prospective aviators shall only receive at the aviation schools instruction in mechanics, physics and other theoretical subjects necessary in aeronautics and military drill.



THE NEWS OF THE WEEK

Tentative Plan by War College

The tentative plan drawn up by the Army War College and submitted to the General Staff, dealing with the composition of the army to be developed from the first 500,000 men called by the President under the selective draft provisions of the new Army Bill, provides for eight aero squadrons and eight balloon companies. The plan is as follows:

DIVISIONS

16 Infantry Divisions; each 913 officers and 27,243 men.
16 Divisional Hospitals; each 24 officers and 222 men.
64 Camp Infirmaries; each .... officers and 2 men.
2 Cavalry Divisions; each 607 officers and 16,021 men.
2 Divisional Hospitals; each 24 officers and 238 men.
6 Camp Infirmaries; each .... officers and 2 men.
Medical Corps (total) 288 officers and 1,000 men.
Coast Art. Corps (total) 666 officers and 20,000 men.

ARMY CORPS TROOPS

16 Brigades F. A. (heavy); each 48 officers and 1,319 men.
8 Aero Squadrons; each 10 officers and 154 men.
8 Balloon Companies; each 19 officers and 154 men.
10 Field Hospitals; each 6 officers and 73 men.
10 Ambulance Companies; each 5 officers and 150 men.
22 Field Bakeries; each 1 officer and 67 men.
6 Telephone Battalions; each 10 officers and 215 men.
16 Pack Companies; each .... officers and 14 men.
6 Ammunition trains; each 4 officers and 852 men.
6 Supply trains; each 2 officers and 426 men.
Grand total, all units, 185,338 officers; 528,659 men.

The officers for this force will be drawn from the Regular Army and the National Guard the Officers' Reserve Corps and "the country at large." The War College recommended that 200,000 men be withdrawn from the army and guard (when both are recruited to full authorized strength) for appointment as company officers and non-commissioned officers in the new army. The College advised against any estimate which would give less than 150,000 men from this source.

It is the specific purpose of the War Department that each regiment in the new forces shall be commanded by an officer from the regular establishment, and that at least one of his majors and all of the staff officers (adjutant, ordinance, supply officers, etc.) shall be experienced men from the regular army.

Steam Aeroplanes Predicted

Detroit.—Abner Doble, vice-president of the General Engineering Company, believes that steam as a motive power for aeroplanes may be used in the near future. The power plant of the Doble steam car which is manufactured by the General Engineering Company develops one horsepower per ten pounds weight, which is a better ratio, according to Mr. Doble, than that of a complete power plant of a gas car and when used in an aeroplane is not encumbered with clutch, change-speed transmission, and starting apparatus, and the ratio of weight to power is greatly reduced. Mr. Doble is experimenting on his power plant for aerial purposes in an endeavor to reduce the weight, and expects to lighten the boiler and engine by careful adaptation of design and the use of special materials. The electrical apparatus may be virtually eliminated by taking advantage of the draft supplied by the propeller and the velocity of the plane. Water supply can be greatly reduced for aviation work, while the weight of the lubricating oil supply would be negligible. Mr. Doble pointed out that the advantages of a steam power plant lie in longer continuous service, tremendous reserve power, and rapid acceleration.

French Airmen Send Greetings to America

The French aeronautical organization, the League Aerienne Française, of Paris, has cabled the Aero Club of America its felicitations and fraternal greetings to the aviators of America, who will soon be with them in the great world struggle. The league, which was founded to promote the cause of military aviation in France, counts among its members some of the foremost men of France.

The cablegram reads:—"The Executive Committee of the League Aerienne Française, founded in October, 1915, to attain the supremacy in military aviation, sends its felicitations and fraternal greetings to the areo clubs of the United States and to the champions of the Grand Republic. We greet the American aviators, who now enter into battle and will alight upon the soil of France, and all those who will come to fight with the allies for civilization and liberty."

Oldfield Motors to Build Aero Engines in Duluth

Duluth, Minn.—A new industry to manufacture aeroplane engines will be established here and will be known as the Oldfield Motors Corp. The aeroplane engine which will be made by this company will be 125 h.p. The company has taken over the old plant here, comprising several buildings, and the main building is 140 by 160 ft. The president of the company is Lee W. Oldfield, and associated with him are John B. Cooper, John P. Ernster, Harry M. Giles and Alfred Kreig.

Wardrop Speaks in Albany

That the engineers and students of modern military efficiency in the Albany district are cordially interested in the subject of aviation was demonstrated on May 4th, when G. Douglas Wardrop, editor of AERIAL AGE, delivered an address at the University Club before a large audience. A number of the auditors made application for enlistment in the Aerial Reserve Corps as a result of the enthusiasm created concerning our air services.

Record Number of Pilots' Certificates Granted

A record number of aviation pilot certificates were granted by the Executive Committee of the Aero Club of America last week. Sixteen men received their certificates, one of whom also received his expert pilot certificate. This brings the total of licensed pilots of the Aero Club of America up to 860, which includes 66 hydroaeroplane certificates, 710 land certificates and 84 expert certificates.

Those obtaining their certificates were: Carl W. Connell, Mayo H. Boulware, Michael Brown, Joseph Bennett, Roland Rohlfs, 1st Lt. Michael F. Davis, U. S. A.; 1st Lieut. James R. Alfonte, U. S. A.; 1st Lieut. Adlai H. Gilkeson, U. S. A.; 1st Lieut. Patrick Frissell, U. S. A.; 1st Lieut. Arnold N. Krogstad, U. S. A.; 1st Lieut. Whitten J. East, U. S. A.; Captain John H. Reynolds, U. S. A.; 1st Lieut. H. M. Brown, U. S. A.; Charles T. Holloway, Harry Wagner, Edward P. Larrabee.

The Expert Certificate was granted to Carl W. Connell, No. 84.

S. A. E. to Meet on June 25-26

Washington.—The summer meeting of the Society of Automobile Engineers scheduled to be held in this city on Monday, June 25, will be a two-day session, instead of a one-day session as previously announced. Monday, June 25, and Tuesday, June 26, will be devoted to the work. Sessions will be held in the Auditorium of the Bureau of Standards, which is some distance out from the center of the city. This change in arrangements followed a two-day conference of several of the members of the council of the society who have been here for two days arranging for the summer meeting and also taking up matters of closer co-operation of the society with the Government.

STANDARDS MEETING JUNE 25

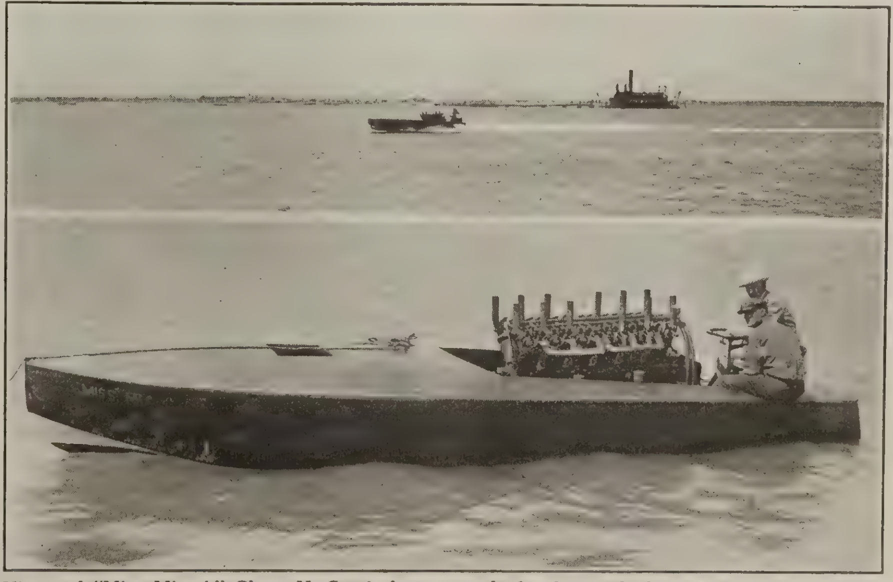
A definite program for the two-day meeting has not been exactly determined upon, but a rough draft shows that the work of Monday, June 25, will be entirely given over to the standards committee, which will meet at 10 A. M. at the Bureau of Standards and continue in session for the remainder of the day.

The evening will be given over to examination of the equipment of the Bureau of Standards and perhaps some special demonstrations arranged for the engineers.

GENERAL MEETING JUNE 26

Tuesday, June 26, will be for the entire membership of the society, the program consisting of a business meeting with president's address and various reports in the forenoon, followed by a professional session in the afternoon, and an informal dinner in the evening. The afternoon session will have approximately three or four papers of a practical nature dealing largely with the work of the different activities of the society in relation to the Government. It is hoped that one of the foreign aviation engineers will present a paper on this subject.

Many members of the society are making headquarters in Washington at present and the New Willard Hotel here recalls a New York hotel at show week, so many of the automobile, aeroplane and tractor people are on hand. Closely associated with Government co-operation are many members of the S. A. E. W. H. Van Dervoort, past-president, has a permanent office in the Munsey Building in connection with his work on standardization of munitions; S. D. Waldon, formerly of Packard and Cadillac, has an office in the same building and is working on matters of aeroplane organization and problems connected with increased production; K. W. Zimmerschied, former chairman of the Standards Committee, is lending aid in a general way and expects to make headquarters here for some time; Charles B. King, one of the pioneers in the automobile industry, has been working with the Government for many months; Henry Souther, former president of the S. A. E., has been connected with the aeroplane department in an engineering capacity for nearly a year. Howard E. Coffin, also past-president of the society, has been giving all of his time to defense work for practically a year. President George W. Dunham, of the S. A. E., has recently been given an appointment on the bureau for the development of motor apparatus for moving field artillery. Roderick W. Stephens, president of the Motor Truck Club of America, is devoting all of his time to recruiting truck drivers.



Views of "Miss Miami," Glenn H. Curtiss' one-step hydroplane, which recently made sixty-six miles an hour in official trials at Miami, Florida, breaking the world's record

Lieut. E. R. Kenneson, who is instructing the members of the Princeton Aviation Corps.

Steinmetz Lectures to Engineers

Mr. Joseph A. Steinmetz, of Philadelphia, President of the Aero Club of Pennsylvania, member of the American Society of Automotive Engineers, and of the National Association of Engine and Boat Manufacturers and various other scientific societies, delivered a lecture before the Brooklyn Engineers' Club on the evening of Thursday, May 3, 1917, on "Aerial Warfare and Some Devices, Terrestrial and Submarine." The lecture was illustrated, and aroused tremendous interest.

Army and Navy Orders

Detailed to 1st Aero Squadron

The following officers are relieved from duty at Signal Corps Aviation School, San Diego, and will proceed to Columbus, N. M., and report to C. O., 1st Aero Squadron, S. C., for duty: Capt. William A. Robertson, junior military aviator, S. C.; Capt. Seth W. Cook, Cav., D. O. L.; Capt. James F. Byrom, junior military aviator, S. C.; Capt. Joseph T. McNarney, junior military aviator, S. C.; 1st Lieuts. Ralph P. Cousins, Cav.; Melchoir McE. Eberts, Inf.; William O. Ryan, Cav.; Charles C. Benedict, Inf.; Lawrence S. Churchill, Inf., D. O. L.; George E. Stratemeyer, Inf.; George W. Krapf, Inf., D. O. L., and Harold M. Clark, Cav., D. O. L. (April 30, War D.)

Sergt. 1st Class Edgar C. Athey, S. C., Aviation School, Memphis, Tenn., is transferred as private to Coast Artillery Corps and to the Coast Defenses of Portland. (April 26, War D.)

Sergt. 1st Class Arthur J. Ohm, S. C., from further duty at Columbus, N. M., to Signal Corps Aviation School, Memphis, Tenn., for duty. (April 27, War D.)

Capt. Howard F. Wehrle, Aviation Section, S. O. R. C., to active duty at Aviation School, Mineola, Long Island, N. Y. (April 27, War D.)

First Lieut. William P. Willetts, Aviation Section, S. O. R. C., to active duty at Mineola, Long Island, N. Y. (April 27, War D.)

First Lieut. Frank W. Goodale, Aviation Section, S. O. R. C., to active duty at Fort Omaha, Neb., Balloon School. (April 25, War D.)

Under the provisions of the National Defense Act, approved June 3, 1916, the organizations hereinafter designated will be organized and stationed as follows:

Second Aero Squadron, Signal Corps, Philippine Islands.

Fourth Aero Squadron, Signal Corps, near San Antonio, Texas.

Fifth Aero Squadron, Signal Corps, near San Antonio, Texas.

Sixth Aero Squadron, Signal Corps, Hawaiian Islands.

Seventh Aero Squadron, Signal Corps, Canal Zone.

The commanding generals of departments to which these units are assigned will complete these organizations by the assignment of such officers and enlisted men of the Aviation Section now in or to be sent to their departments, and by the transfer or enlistment of qualified enlisted men from other branches of the service, or from civil life.

Boards Appointed

A board to consist of Capt. Lewis E. Goodier, jr., retired, and 1st Lieut. John P. Gallagher, M. O. R. C., at Essington, Pa., for examination of candidates for appointment as officers in the Aviation Section, Signal Officers' Reserve Corps. (April 30, War D.)

A board to consist of Capt. Roy S. Brown, junior military aviator, S. C., and 1st Lieut. George W. Woodnick, M. O. R. C., at Chicago, Ill., for examining applicants for appointment as officers in the Aviation Section, Signal Officers' Reserve Corps. (April 28, War D.)

The Southern Department has been authorized to begin the establishment of a new aviation field. Options have been obtained on 1,000 acres of land six miles south of San Antonio, Texas. General Perishing also has been ordered to organize two more aero squadrons, each to have 150 officers and men and twelve aeroplanes.

Special Regulations No. 50, Aviation Section, Signal Corps of the Army, governing its organization, has been issued by the War Department. It is dated April 9, 1917, and relates to personnel and duty, schools, requirements for service in Aviation Section, Signal Officers' Reserve Corps, and Enlisted Signal Reserve Corps, aviation sections, civilian aeronautical schools, etc.

Bureau of Standards Offers Facilities for Summer Session of S. A. E.

Washington.—The Bureau of Standards, under the direction of Dr. Stratton, has advised that its auditorium and other necessary parts of the bureau will be at the disposal of the Society of Automotive Engineers for its Summer Meeting, Monday and Tuesday, June 25 and 26. The bureau has been co-operating with the society in many ways connected with standardization work and this courtesy is another example of how desirous the Government is to work with the engineers.

The meeting on Monday, June 25, will be given over entirely to the work of the Standards Committee.

Tuesday, June 26, will be occupied by the general work of the society, including a business meeting in the morning, receiving of reports, and professional papers in the afternoon.

F. E. Moskovics has accepted the chairmanship of the committee for the informal dinner Tuesday evening, June 26. The exact place at which this dinner will be held has not yet been decided upon. Mr. Moskovics is in the city this week arranging for the dinner and adding to his committee to handle this work.

An example of the types of flying boat hulls being constructed by the Burgess Co., at Marblehead. In the background one of the Burgess hydros.

New York Meeting of Aeronautic Division S. A. E.

A meeting of the Aeronautic Division was held April 20 in New York, those present being Chairman Charles M. Manly, H. M. Crane, F. S. Duesenberg, Spencer Heath, C. B. King and J. G. Vincent, General Manager Coker F. Clarkson and Recorder A. C. Woodbury. The visitors present were: Frank W. Caldwell, Aviation Section, Signal Corps, and M. W. Hanks, of the Westinghouse Electric & Manufacturing Co.

The Division voted to report for adoption the Deperdussin (Dep) and stick controls for aeroplanes. Sketches to indicate the effects of the various control movements will be incorporated in the report.

It was decided to recommend that clincher rims, conforming to the standards of the Clincher Automobile Tire Manufacturers' Association, should be specified for aeroplanes. The rim sizes to be recommended are 24 by 3½, 28 by 4, and 32 by 4½ in. Tires of corresponding sizes are to be used with these rims, as are also oversize tires as follows: 25 by 4, 29 by 4½, and 33 by 5 in.

Considerable discussion was had regarding the standardization of hubs and spokes. It was thought that three sizes of hubs, 6, 7 and 8 in. long, would be sufficient, but it was finally decided to consider the subject again at the next meeting of the Division. Proposals were also submitted for standardizing two sizes of wire spokes, the large size having the butt end bent to an angle of 41½ deg. and the small size an end bent to an angle of 90 deg.

It was voted to recommend the method of fastening ends of hard wires corresponding to the present British standard. This consists of an oval coil of wire, through which the hard wire is slipped, bent in the form of a loop, inserted again and the end bent over against the coil, the hole then being soldered.

Dimensions were submitted for flexible splices for cables from 3/32 to 7/32 in. diameter. It was voted that these splices be proposed for standardization. Dimensions were also submitted for galvanized non-flexible cable ends for cables of from 1/16 to ¼ in. diameters. These splices will probably be recommended for adoption.

A set of thimbles for wire ends has been approved for submission to the Standards Committee. These apply to wire of from 1/16 to ⅜ in. diameter.

The subject of turnbuckles was considered, and it was decided to recommend for immediate adoption short and long turnbuckles, the barrels of which are 2 and 4 in. long, respectively.

It was decided to approve the following pipeline markings for presentation to the Standards Committee: Gasoline pipe lines are to be marked with red stripes ½ in. wide, painted around the pipes 24 in. apart. Oil lines are to be marked with white stripes ½ in. wide, painted around the pipes 24 in. apart.

The following recommendation was approved with regard to specifications for thickness of metal:

"Sheet metal is to be specified by thickness in decimal fractions of an inch. Rods, wires and cables are to be specified by diameter in decimal fractions of an inch. Tubes are to be specified by outside diameter in inches or fractions and thickness of wall in decimal fractions of an inch."

It was voted to recommend the following engine-support dimensions for adoption, omitting all reference to sizes of bolts:

Distance between timbers..	12	14	16
Width of bed timbers.....	2	2¼	2½
Distance between centers of bolts	14	16¼	18½

A resolution was passed that in view of the necessity of arriving at standards that will mean the least possible delay in the production of aeroplane parts, the Division recommends the use of the English system of measurement, except in isolated cases, such as spark-plug threads, for which the metric system is desirable in order to effect interchangeability with some well-established standard.

It was decided to approve a metric spark-plug with an 18-mm. thread and 1½-mm. pitch. The form of the thread is to be the International metric standard. The distance from the gasket shoulder to the end of the shell is to be ⅝ in. The hexagon is to be 1 in. across the flats.

The following list of existing S. A. E. Standards was approved for aeronautic practice—steel specifications, heat treatments, test specimens, ball bearing sizes, throttle levers, magneto dimensions and cotter pin sizes.

Other matters approved for submission to the Standards Committee are a design of tachometer shaft-end and a safety belt adopted by the War Department.

Universities to Be Training Schools

Washington, D. C.—Six universities have been designated by the War Department as training schools for prospective army aviators, who will have two or three months' instruction in physics, mechanics and military drill, beginning in about six weeks. The schools are Cornell, Illinois, Ohio, California and Texas Universities and the Massachusetts Institute of Technology.

Some of the six thousand applicants for the army aviation corps will be selected for assignments to the university after preliminary physical and mental examinations. Meanwhile each of the universities will send three members of its faculty to study practical aviation problems at the Canadian training school, connected with the University of Toronto. Heads of the institutions meeting with Brigadier-General George O. Squier, chief of the army aviation service, agreed to these arrangements.

The War Department intends to send practical aviators to each training school to assist the three faculty members in directing the courses, although the present intention is not to use the university campuses as aviation fields. Actual flying training will be given to the students at the army's aviation camps. All the schools chosen already have military instruction.

Other schools probably will be chosen later for similar training centers.

Arrangements for the university courses were made through the Aeronautics Committee of the Council of National Defence, with which aeroplane manufacturers are co-operating to supply machines ordered by the air department.

A remarkable picture of a Curtiss J. N. tractor taken from F. C. G. Eden's flying boat at Jacksonville, Florida. The two machines were instrumental in discovering a forest fire, the smoke of which can be clearly seen in the lower left hand corner of the illustration.

REGULATIONS GOVERNING THE ORGANIZATION OF THE AVIATION SECTION, SIGNAL CORPS

SECTION I.

PERSONNEL AND DUTY.

1. Personnel.—The aeronautical personnel of the aviation section of Signal Corps will consist of officers and enlisted men of the Regular Army, of reserve officers and enlisted men of the Reserve Corps, of officers and enlisted men of the National Guard mustered into the service of the United States, and of civilians employed by the aviation section of the Signal Corps.

2. Division of duty.—The central office will provide for four divisions of duty:

First. The provision of material to be effected by the central office through its technical departments.

Second. A system of training personnel, to be decentralized but to remain under the general jurisdiction of the War Department similarly to other educational institutions and service schools of the Government.

Third. The establishment, organization, and equipment of tactical units at points to be designated by the War Department.

Fourth. The selection, purchase, and rental of sites for aeronautical purposes.

SECTION II.

SCHOOLS.

Par.
Classes of schools 3
Training 4
Military departments 5
Personnel 6

3. Classes of schools.—Aeronautical schools are divided into three general classes: (*a*) The United States Army aviation schools, (*b*) the United States Army balloon schools, (*c*) civilian schools (aviation or balloon), conducted by manufacturers or others for preliminary training.

4. Training.—The personnel and courses of technical instruction at United States aviation and balloon schools will be in accordance with instructions from the War Department.

It is intended that personnel for all formations, except those of the Regular Army, will obtain their preliminary instruction at civilian aviation or balloon schools, after which they may finish the course at the corresponding United States Army schools and obtain their military ratings.

5. Military departments.—Each department will have an aeronautical officer, to be designated as such, on the staff of the department commander.

Within the department, the aeronautical officer, under the department commander, will be charged with general control of all officers, enlisted men, and civilian employees of the aviation section, Signal Corps, and of all aeronautical schools except in matters relating to changes in courses of technical instruction and such control by the War Department of personnel at such schools as may be necessary to carry out properly the prescribed courses of instruction; with keeping the records of personnel in the Signal Officers' Reserve and Enlisted Reserve Corps, of the aviation section, Signal Corps; with instruction and equipment of all tactical units of heavier-than-air and lighter-than-air craft; with preparation of requisitions for proper supply of new air units both in the Regular Army and the reserve of the Regular Army; with plans for the creation of new air units in the Regular Army and reserve and with all other matters affecting the aeronautical service. General supply depots and experimental stations so designated in orders of War Department and matters relating to changes in personnel and courses of technical instruction at United States Army aviation and balloon schools within the department are excepted from control and supervision of the aeronautical officer.

6. Personnel.—For the aviation section, Signal Corps, will be as now prescribed by law and Army Regulations.

For the aviation section, Signal Officers' Reserve Corps, under section 37, national defense act, will be as prescribed in Special Regulations No. 43, War Department, 1917, as per Section III hereof; and for the Enlisted Reserve Corps, aviation section, Signal Corps, under section 55, national defense act, as prescribed in Section IV hereof.

Requirements for civilian aeronautical schools are contained in Section V.

The method of detailing officers and men of the National Guard, both in and out of the Federal service, for duty at aviation schools under section 99, national defense act, is set forth in Section VI.

SECTION III.

REQUIREMENTS FOR SERVICE IN THE AVIATION SECTION, SIGNAL OFFICERS' RESERVE CORPS.

7. Number and grades of officers.—The section may consist of 296 officers. The grades in said section shall be in the same proportion as those obtaining in the aviation section, Signal Corps, United States Army, to include the grade of major. Unless otherwise authorized by proper authority, all successful applicants for commissions in the aviation section, Signal Officers' Reserve Corps, will be commissioned in the grade of first lieutenant.

8. Letter of application for examination.—Any male citizen of the United States, not under 21 nor over 30 years of age, desiring a commission in the aviation section, Signal Officers' Reserve Corps, will submit a letter in the prescribed form to The Adjutant General, United States Army. The maximum age limit in special instances may be waived upon recommendation of the officer in charge of the aviation section, Signal Corps.

Form of letter of application for examination for commission in Officers' Reserve Corps.

[Under section 37, act of June 3, 1916.]

——— ———,
——— ———, 19—.

[1]To ——— ———
——— ———
——— ———

Sir: I have the honor to apply for examination for a commission as [2]——— aviation section, in the Signal Officers' Reserve Corps, organized under the authority of Congress.

I have served ——— years in [3]———.

I have pursued a regular course of instruction for ——— years in [4]———.

I graduated in the year ——— from [5] ———, after having creditably pursued the course of military instruction therein provided.

I was born ———, [1]———, at ———, and am [6]——— a citizen of the United States. Age ———. Color ———. Height ———. Weight ———.

My business is ———.

My experience is ———.

I inclose letters of recommendation and addresses of three citizens who know me as follows: ——— ———.

Respectfully,
——— ———.

Permanent post office address ———.

The correctness of the statements above made was sworn to and subscribed before me——— ———, 19—.

[7] ——— ———.
——— ———.

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[1] See paragraph 8.

(*Continued on page* 295)

Thorne Donnelley, of Lake Forest, Ill., one of the patriotic young sportsmen who have given up their business to further the interest of the country's aerial preparedness.

THE GALLAUDET NAVY SEAPLANE

IN the Gallaudet Navy Seaplane the structural advantages of the tractor type are combined with the advantageous seating of the occupants that are found in pusher machines. Pilot and passenger, being forward of the planes and propeller, have a wide and unobstructed range of vision which is so necessary in observation flights and in making successful landings.

The company recently delivered to the Navy Department a seaplane equipped with the new Gallaudet patented drive. The propeller efficiency, due to Mr. Gallaudet's patented construction, is 83% against the 75% maximum efficiency usually hoped for in propellers in the past. This type of construction eliminates a great deal of the head resistance, reduces weight, and permits the one four-bladed propeller revolving on a drum around the fuselage to be driven by either or both motors set inside the body of the machine and geared to the propeller shaft.

Another feature that makes for speed is that the centers of thrust and resistance are coincident.

The natural stability found in Gallaudet aeroplanes, produced by the pronounced sweepback and stagger and careful distribution of weights and areas is even more evident in the navy seaplane. Streamlining has cut down head resistance to a minimum and in official flights for the Navy Department, a speed of 92 miles an hour was developed, although the high speed specified by the Department was 88 miles an hour.

With a total flying weight of 4,600 lbs., the cruising radius is 1,000 miles; in straight-away flights, 500 miles and return.

General Dimensions

Span, upper plane	48′-0″
Span, lower plane	48′-0″
Chord	7′-0″
Total lifting area	658 sq. ft.
Gap	7′-7″
Overall length	33′-0″
Net weight, unloaded	3,600 lbs.
Useful load	1,000 lbs.
Speed range	92-45 m.p.h.
Motors, Duesenberg (2) each	150 H.P.

Planes

For the sake of clearness in the accompanying line drawing, the wiring of the cellule and main float has been omitted.

Planes have no dihedral. Sweepback, 8° 30 minutes. Upper plane staggered 77° or 1′-9″ forward of the lower. Planes set at an incidence of 7 inches. Ends of planes are raked at an angle of 22°.

The planes are in six sections. Central sections, above and below the fuselage, 2′-4¼″ wide. Each central section has an area of 23.48 sq. ft. Each of the four outer sections has an area of 138.76 sq. ft.

Ailerons on upper and lower planes each have an area of 13.88 sq. ft.

Center panel struts are centered 2′-4¼″ apart. The center interplane struts are spaced 8′-7.83″ from these. From the center interplane struts the outer struts are spaced 8′-6.308″. This leaves an overhang of 5′-2″ from center line of outer strut to the outer tip of aileron. From forward to rear main wing beam, struts are located 4′-4″ apart.

Fuselage

Overall length 29′-6″. Fuselage is built up of mahogany veneer. Maximum width and depth between the central wing panels, 3′-6″. Sides are flat, with top and bottom rounded off.

The leading edge of the propeller is located 16′-0″ from the nose of the fuselage. Aft of the propeller, the body tapers to a vertical chisel edge, to which the rudder is attached.

The observer and pilot are located in separate cockpits in the nose of the fuselage.

Tail Group

The horizontal stabilizer is divided, one section at either side of fuselage. It is fixed at a lifting or positive angle of 3″ in its length of 6′-0″. Along the rear beam ot the stabilizer, the distance from tip to tip is 10′-4″. The rear beam is situated at the center line of the fuselage, which is also the center line of propeller thrust. Area at either side of fuselage, 15.17 sq. ft. or a total area of 30.34 sq. ft.

Each of the two elevators has an area of 11.5 sq. ft. They measure 12′-0″ from tip to tip and are 2′-6″ wide. Attachment to the stabilizer is by four hinges each.

There is no vertical fin or stabilizer. The rudder is of the balanced type. Maximum width, 3′-6″. Maximum height, 5′-0″. Area, 12.5 sq. ft. The rudder area is equally disposed above and below the fuselage.

Floats

Floats of mahogany. Main float is 25′-0″ long. Maximum beam, 3′-6″. Maximum depth at the step, 2′-6″. Attachment is made to the fuselage by a pair of struts at the forward end and a single strut at the rear end. Attachment to the lower plane is by two pairs of short struts.

The float projects 8′-0″ in front of the upper plane, or 1′-0″ forward of the fuselage nose. The step occurs 13′-6″ from the front of the float. Two air vents are run from back of step to the deck of the float. The bottom is the V type, and the top has a turtle back deck. A rudder for steering on the water is hinged to the float extremity.

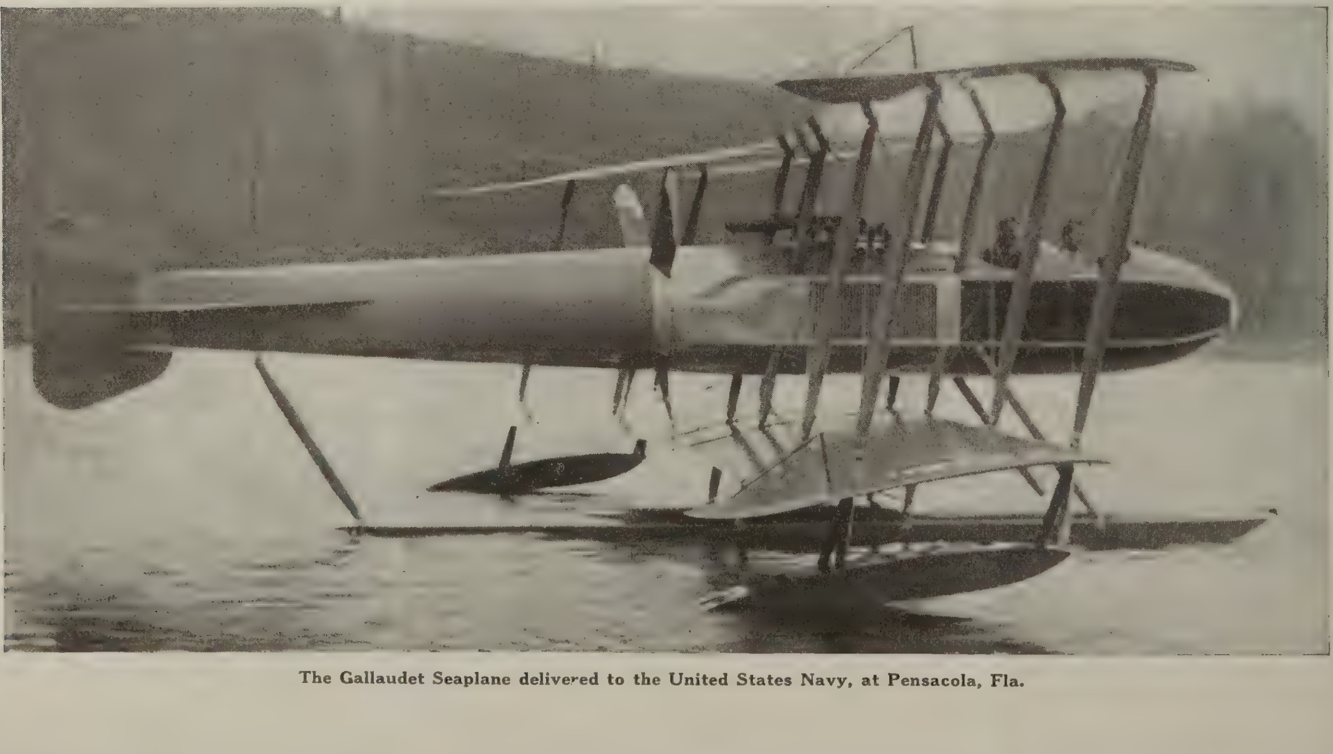
The center line of buoyancy is located at a point 1′-3″ forward of the step. The center line of lift of the machine occurs 1″ back of the buoyancy line. The water line indicated on the drawing is for a load of 3,573 lbs.

Wing tip floats are 1′-3″ wide. Top and bottom flat and sides of streamline contour.

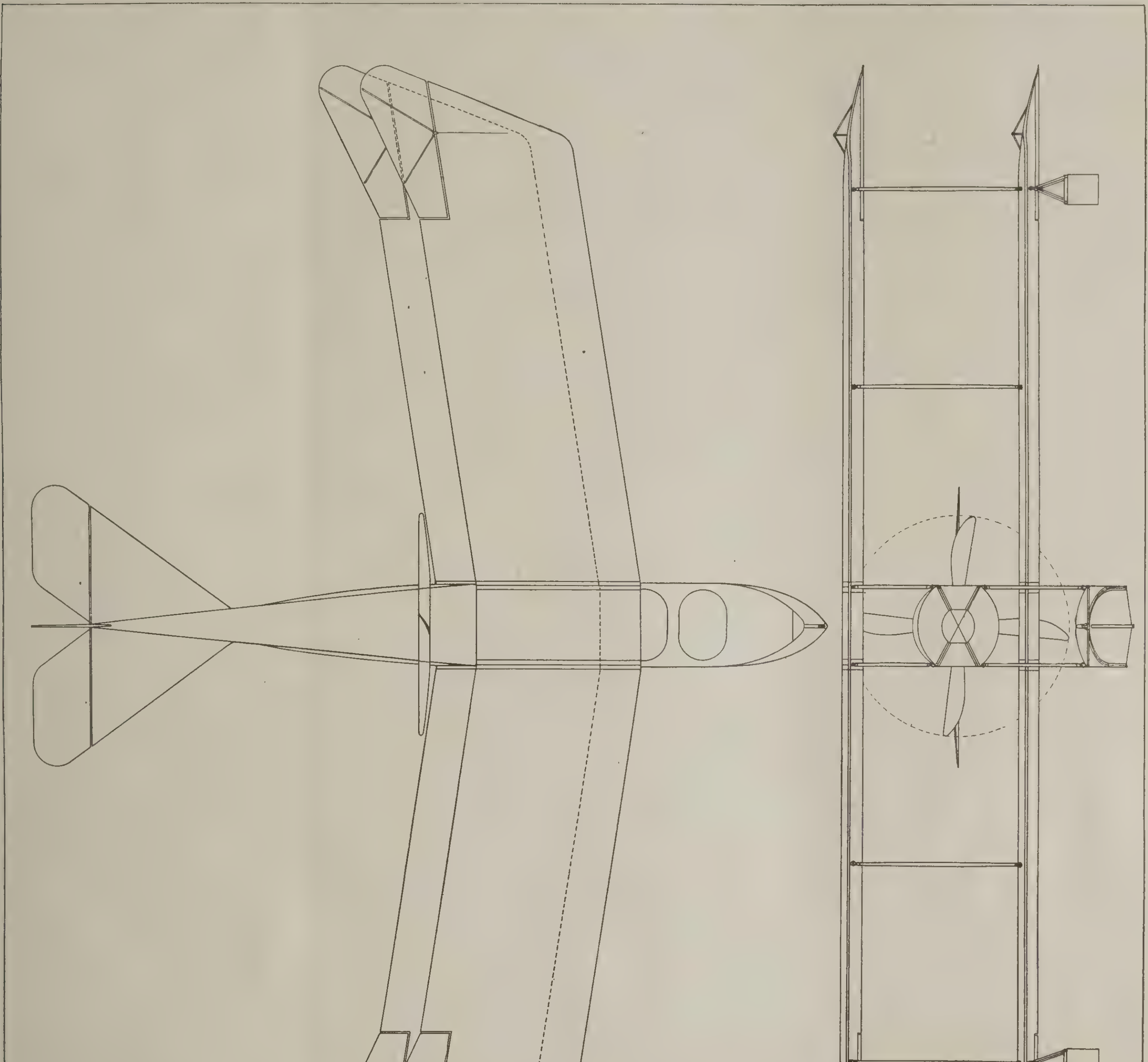
Motor Group

Two Duesenberg 4-cylinder vertical motors are installed in the fuselage. The bore and stroke is 4¾″ x 7″, and it develops 150 h.p. at 2,100 r.p.m. Weight with reduction gear, 509 lbs. A complete description of the Duesenberg motor appeared in the April 23d issue of AERIAL AGE.

The propeller is four-bladed, 9′-6″ in diameter. The blades are attached to a metal ring which encircles the fuselage at a point 16′-0″ from the nose. Spur gears connect the motors to the propeller ring. Radiators built in at either side of the body.



The Gallaudet Seaplane delivered to the United States Navy, at Pensacola, Fla.


GALLAUDET 300 H.P.
NAVY SEAPLANE
Scale of Feet
1 2 3 4 5 6 7 8 9 10 11
McLaughlin

EXPERIMENTAL RESEARCHES ON THE RESISTANCE OF AIR

By L. MARCHIS

CHAPTER I

CLASSIFICATION OF EXPERIMENTAL METHODS

1. Reactions Exerted by the Air on a Body in Relative Movement with It

When a body is in movement relative to the air with which it is surrounded, it is subject to a system of forces to which is given the name of "reactions exerted on the body by the air." These reactions are variable, especially as regards (1) the form of the body, (2) the position which it occupies in relation to the surrounding medium, (3) the various circumstances of its movement (time elapsed from origin of movement to present moment—velocity relative to the air), and, finally, (4) the mass of the fluid which surrounds the body in movement.

We shall not develop in detail the difficulties presented by each of these problems, of which certain have received only very imperfect solutions.

We shall, in what follows, consider only the case of a body surrounded completely by a great mass of air, relative to which it has a movement, established a long time previously, and of which the velocity and direction are constant and readily determined.

The reactions exerted by the air on the body in movement relative to it are reduced to a force and a couple. We shall assume that the body under experiment possesses, at the least, a plane of symmetry, thus eliminating the couple from the reactions of the air and reducing them to a single force, to which we shall give the name of "resistance of the air on the body in movement relative to it."

When we consider the movement of the body relative to the air which surrounds it, we have not only in view a movement of translation, but also a movement of simple rotation and likewise a movement of rotation combined with a movement of translation. In other words, we shall study here the problem of the propeller as well as that of the wings of an airplane.

2. Manner of Producing the Movement of a Body Relative to the Air Which Surrounds It—Body Movable

Various experimental methods may be utilized in order to produce the moveemnt of a body in reference to free air.

In an indefinite mass of air, at rest as a whole, the following types of movement may be given to the body:

(*a*) A movement of rectilinear translation;

(*b*) A movement of rotation about the axis of a mechanism;

(*c*) An oscillating movement, as in the case of a pendulum.

The methods by means of some form of mechanism or by means of a pendulum have been but little employed in France and we shall omit special reference to them.

The method employing the motion of translation may be applied in two forms:

(1) The body is allowed to fall freely in air, as calm as possible.

(2) The body is carried on some form of car which is moved in calm air.

In France the method of free fall has given rise to important investigations made by MM. Cailletet and Colardeau and especially by M. G. Eiffel.

The method by means of a car is now utilized by the Aerodynamic Institute of Saint-Cyr, at the laboratory of military aerostation of Chalais-Meudon, and also by M. the Duke of Guiche. At Saint-Cyr and at Chalais-Meudon, the car is composed of a carriage moving on rails. M. de Guiche employs an automobile as a carrier.

A variant of the method of the car has been installed at the laboratory of military aviation at Vincennes. On a stretched cable a little hanging car rolls, carrying, attached below it, the objects under test with the necessary instruments.

The dimensions of the bodies on which the experiments are carried out may be of the order of those which are utilized in aviation itself. In other words, it is possible to operate upon equipment as used in actual aviation, or at least presenting dimensions differing but little from those used in practice.

From this point of view the method by displacement through the air opens up a field of investigation more extended than the method in which an artificial current of air is employed.

3. Manner of Producing the Movement of a Body Relative to the Air Which Surrounds It—Artificial Current of Air

It is possible, in fact, to realize in an entirely different manner the relative movement of a body through the air.

Instead of moving the body under test, a fixed position is given to such body placed in an artificial current of air.

The body may then be disposed in the free air in front of the orifice through which the air enters under regulation by means of suitable devices. This method has been employed by M. Rateau.

The body under investigation may also be placed in an inclosure or integral part of the apparatus for the regulation of the current of air. It is placed, for example, in a part of a large cylindrical pipe which receives a current of air produced by a fan and of which the velocity, at a certain distance from the walls, has been rendered sensibly parallel to the pipe.

This method, furthermore, may be subject to certain variations:

(*a*) The body under investigation alone is placed in the inclosure in the interior of which the artificial current of air is produced. The apparatus for measuring the reactions of the air are on the exterior of this enclosure, their connection with the interior being made through the solid wall which limits the conduit.

This method is known under the name of the "tunnel method." It has not been largely employed in France. There exists at the present time at the Aerodynamic Institute of Saint-Cyr a tunnel of which the practical use has been interrupted by the present war.

(*b*) The apparatus employed for determining the circulation of the air is enlarged into a chamber of suitable size, traversed between two of its parallel walls by a cylinder of moving air. On the outside of the latter and within the chamber are located the experimenters with the necessary measuring apparatus.

We propose to call this the "Eiffel method."

In France this method has given very complete results. It is for us the characteristic method in connection with the use of an artificial current of air.

From the point of view of the convenience of carrying on the experiments, especially in large numbers, the last method is superior to the method by displacement in free air. The latter demands, in fact, that the external air shall be as calm as possible. This condition can only be realized on certain days and then only for certain hours of a given day. If along the right-line path of the body under investigation the wind should have everywhere the same intensity and the same direction, due allowance might be made for its existence.

But many investigations, notably those of M. Maurain at the Aerotechnic Institute of Saint-Cyr, show that at any given point in the air the wind is frequently subject to continued changes in direction and intensity.

But even if it allows the experimenter to regulate the conditions of any one investigation, the method by the use of the artificial current of air can only be applied to models reduced in size in comparison with actual practice in aviation. We shall see later the reason for this limitation.

One question immediately presents itself: How may the results obtained in the study of models be transformed in order to furnish information applicable to apparatus of full size? What is the law of similitude which makes possible the transformation of an investigation on a small scale to corresponding phenomena on a large scale. This is the matter which we shall especially develop at a later point.

A further question presents itself: Do the methods mentioned above, namely, the displacement of the body under investigation and the method by the artificial current of air, lead to the same results? M. Eiffel maintains the affirmative, relying upon the fundamental principle of relative movement. M. de Guiche maintains the negative, arguing that the tunnel method does not realize fully the conditions which permit the application of such a principle.

We shall return to this question at a later point, in connection with the comparison of the results obtained by these two experimenters.

4. Studies of Aeroplanes in Free Flight

The methods which we have just considered require that the body under investigation be connected in a fixed manner with a support. The latter has, under good conditions, its dimensions reduced as much as possible. It is also removed as far as possible from the body under investigation, so that its presence will produce the minimum of disturbance. It is none the less true, however, that the airplane, thus studied, is not in the precise condition of free evolution in the open air.

For this reason investigations have been undertaken on aeroplanes during their free flight in the air. Unfortunately, the field of such investigation is limited. It can not be carried through at the will of the experimenter; that is to say, of the pilot, who must first of all guard against danger of fall. Such experiments give complex results often difficult of analysis. Nevertheless it can not be denied that such results may have a very considerable practical value.

Experiments of this character were inaugurated in 1910 by MM. Gaudart and Legrand with a Voisin biplane. These experiments were, however, neither sufficiently systematic nor numerous to lead to significant results.

Quite otherwise are the researches made by Commander Dorand, at Villacoublay, on a biplane of his own construction piloted by M. Labouchère. At the Institute of Saint-Cyr, MM. Toussaint and Lepère, Toussaint and the Lieutenant of Aviation Gouin, have made important experiments on a Maurice Farman biplane and on a Blériot monoplane. Ingenious apparatus capable of registering the movement of the pilot was employed to furnish important indications regarding the operation of such actual aviation equipment.

5. The Total Resistance of the Air and the Determination of the Pressures at Each Point of the Surface of the Body Under Investigation

Let us return to the methods which, in a laboratory, may be employed in determining the resistance of the air upon a body in movement relative to it.

With regard to the method of measuring this resistance two types may be characterized:

(1) Determination, by means of a balance, of the total resistance on the entire body under investigation.

(2) Determination, at each point of the body, of the reaction exerted by the air at this point; a study, in some manner topographical in character, regarding the pressures resulting from the relative movement of the body and the air.

This investigation immediately leads, through a geometrical composition of the individual forces thus determined, to a knowledge of the complete resistance of the air.

The method by means of the balance has given wonderful results in the laboratory of M. Eiffel and at the Institute of Saint-Cyr. M. de Guiche has applied this method solely to the analysis of the distributed pressures.

Such is the general classification of the experimental methods at present in use in France for the study of the problems of aerodynamics. We proceed to give in detail the fundamental principles of these investigations in a further study of the French aerodynamic laboratories.

CHAPTER II

THE AERODYNAMIC LABORATORIES OF FRANCE

1. The Eiffel Laboratories—Experiments Made at the Eiffel Tower

The Eiffel Tower was the first laboratory utilized by the celebrated engineer in his researches in aerodynamics, carried on during the past ten years. Bodies thrown from one of the platforms of the tower have permitted a study of free fall in calm air.

The study of this movement admits, furthermore, of being made by two different methods.

The first of these methods consists in determining the velocity of uniform movement which succeeds the varying movement. To this velocity corresponds a resistance of the air equal to the weight P of the body. By augmenting the weight of the body without changing the surface, as by the addition of suitable ballast, it is possible to increase, at the same time, the limiting uniform velocity V of the movement. The comparison of the different values of P with the corresponding values of V provides a means for developing a law of variation of resistance as a function of velocity. Such is the principle of the method applied in 1892 by Cailletet and Colardeau from the second story of the Eiffel Tower (120 meters = 394 feet above the ground).

Instead of limiting himself to the study of that part of the free fall that corresponds to uniform movement, M. Eiffel registers the values of the velocity and of the resistance of the air at each instant of the fall. The principle involved in this investigation is the following:

The surface under investigation, a plane for example, falls freely, remaining horizontal. It is supported by a spring, of which the displacements are inscribed on a cylinder revolving with a velocity directly proportional to that of the fall of the system under investigation. The compression of the spring, as a result of the resistance of the air, gives rise to a force which, by a suitable calibration, may be deter-

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Reprinted from the Second Annual Report of the National Advisory Committee on Aeronautics.

mined as a function of the displacements of this spring. This force produces equilibrium with the following system of forces:

(1) The weight of the system.
(2) The forces of inertia which act upon it.
(3) The resistance of the air.

It is then possible to calculate this last force when the acceleration of the system is known. To this end it is sufficient to inscribe, by means of a tuning fork, the time of fall on the same cylinder whereon are recorded the compressions of the spring.

In a certain experiment, when the combined weight of the plate with its spring and support was 4.494 kilograms (9.887 pounds), the following determinations were made, in one case at the end of 60 meters of fall (196.8 feet) and in the other case at the end of 95 meters (311.6 feet):

At the end of 60 meters:		
Force of inertia........	3.76 kg.	
(Absolute value.)		
Tension of spring......		4.15 kg.
Resistance of the air....		4.90 kg.
Difference		=0.75 kg.
At the end of 95 meters:		
Force of inertia........	3.36 kg.	
(Absolute value.)		
Tension of spring......		6.15 kg.
Resistance of the air....		7.30 kg.
Difference		=1.15 kg.

These numbers show that under the existing conditions (total weight of plates, of spring, and of support rather high) the difference between the tension of the spring and the resistance of the air is clearly measurable.

By this method, M. Eiffel has studied the resistance of the air on planes of which the surfaces varied from 1/16 square meter (0.67 square foot) to 1 square meter (10.77 square feet) and of which the velocities of fall ranged between 18 and 40 meters per second (59 to 131.2 feet). These high velocities have made it possible to operate in the open air with high precision in calm weather and as long as wind velocities did not exceed 2 to 3 meters per second (6.56 to 9.84 feet per second). The results obtained by these experiments are excellent for planes falling horizontally. They are less worthy of confidence for planes inclined to the vertical.

2. The Eiffel Laboratory—Method by the Use of an Artificial Current of Air

This method, which consists in placing a model in the cylinder of air flow created by a fan, should be applied with the following precautions:

(1) It is necessary that the model should be placed in a mass of air theoretically indefinite, practically very great, and having a velocity constant in magnitude and in direction.

The section of the cylinder of air should be sufficiently large, in order that at the periphery the velocity of the air may be sensibly the same in magnitude and in direction as that of the air which has not yet approached the obstacle. In this method it is necessary to realize, first of all, a cylindrical current of air, and then to introduce into this current a body of dimensions so small by comparison that its presence shall not produce any sensible disturbances at the periphery of the current. Experience has shown that the ratio of the greatest dimension of the model to the diameter of the cylindrical current should not exceed 45 per cent.

(2) It is very necessary that the model under investigation shall be practically isolated in the current of air; that is to say, that the support of the model shall play only a negligible rôle and shall introduce no perturbations of importance.

(3) It is necessary that the model adopted shall not be too small in size if it is desired to extend in a more or less significant manner the results obtained with such model to full-sized apparatus.

In fact, when a study is made of the distribution of pressure over the various points of a plate, for example, either on the face directly exposed to the action of the current of air, or on the reverse face, it is found that this distribution becomes regular only at a certain distance from the border. There exists, both in front and behind, a central zone in which a regular regimen is established, which is manifest by isobars parallel to the forward edge. In order that this central zone may be studied, it is necessary that the dimensions of the plate under investigation be sufficiently large. In fact, the width of the marginal zone in which the pressures are irregularly distributed does not vary proportionally with the dimensions of the plate. The experiments of M. de Guiche show that this width varies but little with the dimensions of the plate. In operating on thin rectangular planes with the attacking edge perpendicular to the direction of movement, M. de Guiche has found that the marginal bands of irregular condition have a sensibly constant width, equal to 20 centimeters (7.88 inches) in front and to 40 or 50 centimeters (15.76 to 19.7 inches) at the rear. He concludes that it is well not to operate with planes having a spread less than 1 meter (3.28 feet). In the study of curved surfaces, M. de Guiche found marginal bands of disturbance of which the sensibly uniform width scarcely exceeded 20 centimeters (7.88 inches) on the two faces. It is well, therefore, to use only surfaces whose spreads are superior to 40 centimeters (15.76 inches). When lesser spreads are employed the results obtained by the use of small models do not permit of deducing, in a sufficiently precise manner, the results which would be given by the wings of an aeroplane of normal size. In the case of very small models the mode of distribution of pressure has but a very remote relation to that which would be found on wings of normal dimensions.

This condition of only using, for experimental purposes, models of sufficient dimensions leads, in the method by the use of an artificial current of air, to the employment of very large sections for the cylinder of air. For example, a study of planes having a spread of 1 meter (3.28 feet) can only be made in a cylinder of air of which the diameter is greater than $100/.45 = 220$ centimeters (86.7 inches), approximately. As to curved surfaces, it would be sufficient to provide a cylinder of a diameter greater than $40/.45 = 89$ centimeters (35 inches), approximately.

In France, M. Rateau has utilized the method by the use of an artificial current of air. His apparatus comprises the following items:

(1) A helicoidal fan, 1.2 meters diameter (47.3 inches).

(2) A wooden chamber, 1.5 meters on the side (59.1 inches). The purpose of this chamber is to suppress, by means of suitable partitions, the turbulence produced by the fan and to create a current of air with the velocities of movement equal and parallel throughout.

(3) An outlet orifice of 0.7 meter (27.6 inches) diameter from whence issues a cylindrical current of the same diameter.

(4) A weighing balance located in the outside air at a little distance from the orifice through which the current of air issues.

Such an apparatus would permit of realizing velocities of the air reaching 35 meters (114.8 feet) per second. The diameter of the cylinder of air, however, is too small. M. Rateau was not justified in introducing into this current plates 30 by 50 centimeters (11.8 by 19.7 inches) or biplanes 15 by 50 centimeters (5.9 by 19.7 inches) (separation of planes 20 to 30 centimeters = 7.9 to 11.8 inches). The supports of the objects under investigation and of the measuring equipment were too large, causing very considerable perturbations. The experiments of M. Rateau should be noted as of historic interest, but they can be scarcely considered as having a definitive value.

Much more complete and certain are the results obtained by the installation of M. Eiffel. The Eiffel apparatus comprises the following items:

(1) An orifice from which issues a cylindrical current of air.

(2) An experimental chamber where the air is at a pressure less than normal and where are located the experimenters and the measuring apparatus.

(3) A diffuser.

(4) A fan placed at the end of the diffuser.

The current of air which enters through the orifice in the wall of the experimental chamber and which leaves through the opening of the diffuser placed in the wall opposite and parallel to the first, is a current of air produced by aspiration and not by pressure, as in the installation of M. Rateau. The aspiration removes the influence due to the turbulence produced by the fan, and a regulating box for the current of air in front of the orifice is not necessary. However, certain grillages placed in the openings for entrance to and issue from the experimental chamber play the rôle of regulators for the current of air.

In the laboratory of the Champ de Mars the fan was placed near the opening through which the air leaves the chamber. A large conduit of wood received the air issuing from the fan and, gradually reducing in size, conducted it through a passage ending in the shed, whence the air was drawn into the orifice through which it entered the experimental chamber.

The cylinder of air had a diameter of 1.5 meters (59.1 inches).

The maximum velocity of this air was equal to 18 meters (59 feet) per second, or 65 kilometers (40.4 miles) per hour. The fan employed, of the centrifugal type, delivered 31 meters^3 (1,095 cubic feet) per second, corresponding to a velocity of 18 meters per second and to the circular section of 1.5 meters diameter, requiring 60 horsepower.

The laboratory installed at Auteuil by M. Eiffel is much more powerful. The cylinder of air of the large equipment has a diameter of 2 meters (6.56 feet). Velocities of the air may be realized from 2 to 30 meters (6.56 to 98.4 feet) per second. A second smaller cylinder of air, having a diameter of 1 meter (3.28 feet), parallel to the first, provides velocities from 2 to 40 meters (6.56 to 131.2 feet) per second.

The 60 horsepower is, however, not exceeded in this new installation, in which the delivery of 90 cubic meters of air (3,179 cubic feet) per second may be realized, corresponding to the circular section of 2 meters diameter and a velocity of 100 kilometers (65.14 miles) per hour.

This increase in efficiency is realized by interposing between the experiment chamber and the fan a divergent orifice forming a diffuser. This diffuser has a diameter equal to 2 meters at the outlet from the chamber; it connects with the ring of a helicoidal fan of 3.8 meters diameter (12.46 feet), providing for the flow of the air a useful section of 9 square meters (96.9 square feet). The reduction of velocity which is produced by passing through the diffuser, as a result of the progressive increase in diameter, raises the pressure of the air by a certain quantity and diminishes correspondingly the power which must be furnished to the fan in order to bring the air to atmospheric pressure.

The measure of the total resistance of the air is made in the experiment room by means of a balance, into the detail of which we can not here enter.

The pressures exerted on each point of the body subjected to the action of the current of air are determined by means of orifices of very small diameter fixed normally to the surface at various points of the body and connected with manometers.

This installation likewise provides for determining, with reduced models of screw propellers, the thrust of the propeller and the power required on the shaft. By means of a small electric motor the propeller is turned in the cylinder of air produced by the fan. It is assumed that by this means the same conditions are realized as though the propeller itself advanced through the air.

The propeller models have a diameter which does not exceed 1 meter (3.28 feet). In a cylinder of air of 2 meters (6.56 feet) diameter the propeller model is thus surrounded by a mass of air sufficiently thick to represent action in an indefinite medium.

3. The Aerotechnic Institute of Saint-Cyr

The Aerotechnic Institute of Saint-Cyr was created by M. Henri Deutsch de la Meurthe, who gave it as a gift to the University of Paris. Its purpose is to follow lines of research, both theoretical and practical, tending to the improvement of the means of aerial locomotion in all its forms, these researches being carried out under conditions as nearly as possible similar to those actually in practice.

In order to realize this program, there was constructed on the level a railway 1,350 meters in length (4,428 feet), on which are operated special cars.

The car for the tests of surfaces and of airplanes is an electric tractor with normal gauge. The principal characteristics are as follows:

Weight, not equipped, 5 tons.
Length, 6 meters (19.7 feet).
Width, 2 meters (6.56 feet).
Height, 1.10 meters (3.61 feet).

The current is taken by lateral shoes sliding on conductors placed on either side of the line.

The motor is of 130 horsepower capacity, separately excited. It is geared to two intermediate shafts, upon which are placed pinions which transmit the movement to the forward and rear axles by Renold chains. All the shafts of the motor and axles are provided with roller bearings.

The brake is applied electrically, with a safety provision, by means of shoes at the rear, engaging at the end of the line on a sliding way.

The control is exercised from an operating cab by means of a controller and an adjustable automatic accelerator.

The maximum velocity of the car is about 20 meters (65.6 feet) per second.

The car is furnished with a special mounting providing for registering the following items:

(1) The vertical component force or lift.
(2) The horizontal component force or drift. (These together define the resistance of the air in magnitude.)
(3) A rotating couple, from which, with the preceding, may be derived the location of the resistance considered as a single force.

The relative velocity of the body under trial with relation to the air is determined by measuring the absolute velocity of the car with reference to the ground and adding or subtracting the velocity of the wind according to the direction of the line on which the car runs.

The absolute velocity of the car with reference to the ground is measured by means of a registering speed instrument giving directly the revolutions of an axle. Furthermore, there is installed along the line a system of electric contacts inscribing points of reference on the cylinder of a precision chronograph. This cylinder permits a measurement (to 1/200 second or to 1/10 second) of the time required by the car for traversing a known distance—95.9 meters exactly (314.55 feet).

In order to have the correction due to the wind, measurement is made, at a fixed point on the line where the tests are made, of the magnitude and direction of the wind. The velocity of the wind is measured by an anemocinemographe, which is extremely sensitive (20 millimeters (0.788 inch) for 1 meter (3.28 feet) per second velocity). The direction of the wind is measured by a self-registering wind vane. Furthermore, the correction for the wind cannot

(*Continued on page* 300)

D'ORCY'S AIRSHIP MANUAL

(Excerpts from the forthcoming "D'Orcy's Airship Manual," published by the Century Co., obtainable through the Aeronautic Library, 280 Madison Avenue)

(*Continued from page* 261)

GERMANY

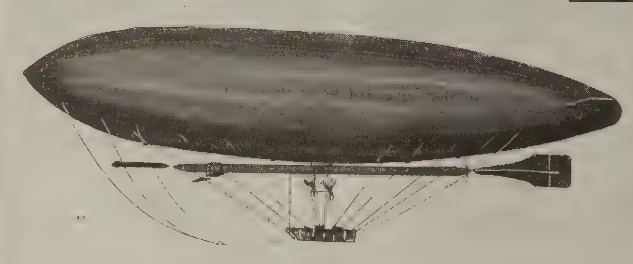
Luftschiff-Antriebs-Gesellschaft, Berlin—Builders of airships fitted with a screwless propulsion system (Meyer's patents).

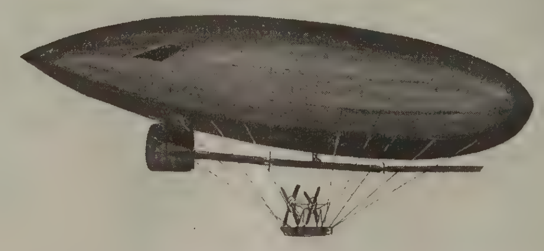
Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	L. A. G. I. (1912)	60	10.4	4,000	50		Experimental airship.—Hull of the condemned Prussian Army airship *P.I.* One Adler engine; orthopteric propellers. Trials were inconclusive.
2	L. A. G. II.	98	15	18,000			Experimental airship built to the designs of Mr. Wischnewsky. (Data & photo wanted.)

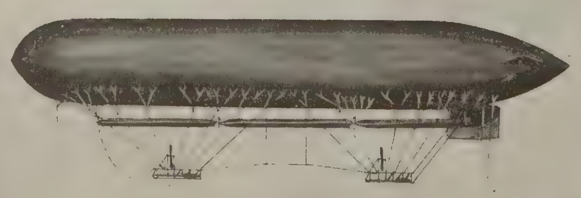
Prussian Army Airship Works, Berlin-Tegel—Builders of keel-girder pressure airships to the designs of Major Gross and Herr Basenach. Special feature: Demountable metal keel hung from the hull. Trim controlled compensating ballonets and trimming tanks, worked by compressed air.

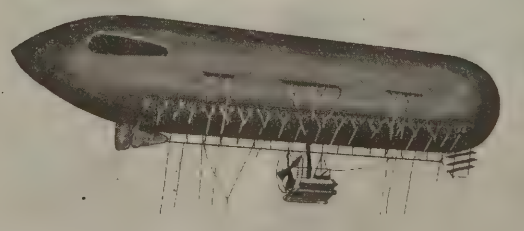
Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	M-a (July, 1907)	41	7	1,400	25	30	Experimental airship.—One Körting engine; twin-screws. Gave little satisfaction and was re-built. Best endurance 200 km in 8 hrs.
1a	(November, 1907)	42	9	1,800	30	32	
2	M. I. (January, 1908)	71	12	5,000	150	42	Prussian Army airship.—Two Körting engines; twin-screws. Was twice entirely re-built and met with numerous accidents. Best endurance 282 km. in 13 hrs.
2a	(August, 1909)	71	12.5	5,200	150	40	
2b	(June, 1911)	74	11	6,000	150	45	
3	M. II. (April, 1909)	71	12.5	5,200	150	40	Prussian Army airship. Two Körting engines; twin-screws. Best endurance: 460 km. in 16 hrs. Rebuilt to match the third type of M-I; was destroyed on Sept. 13th, 1911, during the Army maneuvres by spontaneous combustion.
3a	(August, 1911)	74	11	6,000	150	50	
4	M. III. (December, 1909)	84	12.4	6,700	200	52	Prussian Army airship.—Two Körting engines; twin-screws. Best endurance: 370 km. in 12½ hrs. Rebuilt and re-fitted with four 75 h.p. Körting engines; was destroyed in the shed of Tegel on Oct. 10, 1912 by a fire.
4a	(January, 1911)	90	12.4	9,000	300	60	

GERMANY


Prussian Army Airship Works - "M.I" (1908-'09)


Prussian Army Airship Works - "M.III" (1909)


Prussian Army Airship Works - "M.IV" (1911)


Ruthenberg - "R.I" (1909)

GERMANY—(Continued)

Prussian Army Airship Works. Berlin-Tegel—(Continued)

Works No.	Name Trials	Length (m)	Beam (m)	Volume (m c)	Power (k m)	Speed (h p)	Notes
5	M. IV. (March, 1911)	96	12	10,000	400	68	Prussian Army airship.—Four Körting engines; two pairs of twin-screws. Best endurance km. (Gotha-Metz) in 8 h. 40 m. Re-built and re-fitted with three 150 h.p. Körting engines. (Photo wanted.) No definite information is available regarding the output of airships during the war; in view of the fact that the Prussian Army Airship Works served in time of peace chiefly as an experimental station, it does not seem, however, likely that large numbers of airships have been produced since.
5a	(1913)	102	13.5	12,000	450	75	

Ruthenberg (H.), Weissensee (Berlin)—Builder of pressure airships of the keel-girder type. Trim controlled by lifting planes. Girder of steel-tubing.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	R. I. (September, 1909)	40	6.5	1,150	24	36	Touring airship of Herr H. Haase of Hamburg. One Benz engine; one pusher-screw. Designed endurance: 5 hrs. with a crew of three. Ballonet: 230 mc.
2	R. II. (1911)	46	7.4	1,700	75	45	Excursion airship.—One F. I. A. T. engine; one pusher-screw. No lifting planes; height control through a movable weight. Ballonet: 300 mc. Was partly wrecked on landing near Crefeld on June 1st, 1911.
3	R. III. (1913)	65	11	2,700	150	55	Excursion airship.—Two F. I. A. T. engines; twin-screws. Lifting planes. Ballonet: 450 mc.

(Continued from page 289)

[2] Insert grade, first lieutenant, captain, or major.

[3] Insert service in the Regular Army of the United States, or Volunteer forces of the United States, or Organized Militia of any State, Territory, or District of Columbia; also state in what capacity.

[4] Insert name and location of the school or college.

[5] Insert the name and location of the educational institution.

[6] Insert "not" if in accordance with fact.

[7] Oath to be taken before, and signature to be made by, officer authorized by law to administer oaths.

9. Examining boards.—The communication authorizing the examination of the applicant will be sufficient authority when submitted to the president of the examining board before which the applicant will be instructed to appear. This board will consist of from two to five commissioned officers of the Regular Army of the United States, or of regular and reserve officers of the Signal Corps, including at least one and not more than two medical officers. At least one officer of the Regular Army will serve on each board. This board will be appointed on request made by the officer in charge of the aviation section of the Signal Corps to The Adjutant General of the Army.

10. Examination.—Each applicant, except those commissioned in a nonflying capacity, will be subjected to the same physical examination as is required of officers of the Regular Army applying for aviation duty. Those commissioned as nonflying officers will be given the examination required of applicants for a commission in the Reserve Corps of the line of the Regular Army. The mental examination may be omitted, but the equivalent of a college education will be required. The examining board will consider documentary evidence submitted by the applicant. It may seek additional information by practical tests, personal questions, or by procuring additional documentary evidence. Flying ability will be given first consideration, noted and reported in the proceedings of the board. No applicant for a commission as an officer of the aviation section, Signal Officers' Reserve Corps, will be considered proficient until he is able to pass the flying test for Reserve military aviator, unless specially excepted for reasons stated by the officer in charge of the aviation section, Signal Corps of the Army. Candidates for commissions in the aerostatic division, aviation section, Signal Officers' Reserve Corps, must be experienced balloon pilots and qualified as such according to the standard fixed by the International Aeronautical Federation.

11. Proceedings and recommendations of boards.—After the required examination, the proceedings of the board will be forwarded to the headquarters of the convening authority, with the recommendations of the board as to the qualifications of the applicant. The officer in charge of the aviation section, Signal Corps of the Army, will recommend to The Adjutant General of the Army the grade in which each candidate should be commissioned. After appointment by the President, The Adjutant General will issue the commission. These commissions will be in force for a period of five years, unless sooner terminated at the discretion of the President. Such officers may be recommissioned either in the same or higher grades for successive periods of five years, subject to such examination as may be prescribed. All officers will be eligible for promotion upon the recommendation of their commanding officer subject to such examinations as may be prescribed.

12. Duty and pay.—In time of actual or threatened hostilities officers of the Officers' Reserve Corps are subject to such duty as the President may prescribe. The Secretary of War may order reserve officers to duty for periods not to exceed 15 days a year, and while so serving such officers will receive the pay and allowances of their respective grades in the Regular Army.

With the consent of the reserve officers concerned, and within the limit of funds available for the purpose, officers of the Officers' Reserve Corps may be retained on active duty for such periods as the Secretary of War may prescribe.

13. Aviation or balloon students.—In order to qualify for examination as officers of the aviation section, Signal Officers' Reserve Corps, especially qualified citizens of the United States not under 21 nor over 30 years of age who desire to become flyers will be assisted by the United States as follows: To become eligible for obtaining such assistance the person desiring it shall make application to The Adjutant General, who, if the applicant is considered desirable, will cause such applicant to be examined by a board convened for the examination of officers of the aviation section, Signal Officers' Reserve Corps. The board will pass on the applicant's physical, mental, and moral qualifications. The physical test shall be the same as that required for officers of the Regular Army applying for aviation duty. The applicant will be required to establish the fact that he has the equivalent of a college education and to produce evidence of his reliability and good habits. The candidate will be required to state in writing that if he successfully passes his aviation tests he will become an officer in the aviation section, Signal Officers' Reserve Corps. If the candidate successfully passes, the board will so recommend to the War Department. The Adjutant General will then designate the applicant as an aviation or balloon student. When the student enlists in the aviation section of the Enlisted Reserve Corps he will be made a noncommissioned officer and placed on active duty up to the time that his course is completed and he is discharged to accept a commission in the aviation section, Signal Officers' Reserve Corps. Department commanders are authorized to appoint boards of officers to determine whether or not aviation or balloon students, on active duty, are unsuited for the duties of aviation officers, and when such a board finds any student unsuited for aviation training the department commander may cause further instruction to terminate and the student to be relieved from further active duty and returned to his home to await action by the War Department on the question of his discharge. Such school may be either a United States aeronautical school or a civilian aviation or balloon school.

Upon the candidate's satisfactorily passing the reserve military aviator's test he will be eligible for commission as an officer in the aviation section, Signal Officers' Reserve Corps, without further examination.

(To be continued.)

FOREIGN NEWS

FRANCE

The French Ambassador to Switzerland, says a Havas dispatch from Berne, called on the Chief of the Swiss Political Department February 4 to express the regret of the French Government that through an error a French aviator flew over and bombarded the Swiss town of Porrentrui on April 26. He said that an investigation was being made and that proper punishment would be administered as soon as the facts were established. The Ambassador, it is added, offered, in the name of France, full indemnity for the damage sustained.

A dispatch from Berne on April 26 said that an unknown aviator had dropped explosive bombs on Porrentrui. Several buildings were damaged and three persons, including a child, were injured.

A letter from the American escadrille with the French army says that on the morning of April 22 all the American airmen accompanied a bombarding expedition to Essigny and returned safely.

While they were about nine miles within the German lines Raoul Lufbery discovered four German monoplanes, which he believes belong to the "flying circus" that makes a specialty of trapping solitary French airmen. He found himself up against novel tactics when he attacked them. They chased each other in a close circle, so when Lufbery attacked one the others could fire on him from behind.

The American was forced to give up the attempt after trying three times to bring down one of them. Finally one left the others and started to get above Lufberry, but the latter was able to climb so much faster that they all gave up the attempt to trap him and departed.

The American escadrille was cited recently in army orders for its good work. Ray Claflin Bridgman has joined the escadrille, coming from Belfort, where he has had a month's flying experience.

Paris, May 1.—Rene Seitz, a nineteen-year-old French aviator whose mother lives at Senlis, crossed the French frontier from Switzerland today, after escaping from a German prison camp at Lechfeld, Bavaria. He had been there since June 22, 1916, when he took part in the great French reprisal raid on Karlsruhe.

Seitz's aeroplane was riddled with German bullets and his engine struck, forcing him to alight. Sergt. Marcel Maurin of the "Blue Devils," as the Chasseurs Alpine are usually called, and a Russian infantryman accompanied Seitz in his daring escape.

The trio assert that the hatred of Germans against the United States has been fanned into a volcano by the declaration of war, and that many of the lower classes admit the Allies must win now.

GREAT BRITAIN

London, May 6.—A victory by a British air squadron of six machines over a German contingent of between fifteen and twenty 'planes is recorded in to-night's official statement.

The Germans, flying in several groups, attacked the British airmen and succeeded in breaking up the squadron formation. But the British pilots continued to support each other and brought their machine guns into effective play. One of the German machines was brought down just within the British lines.

Then the fight shifted over the enemy's territory, where two more hostile machines were seen to drop and crash. Finally two others were sent down out of control, whereupon the remainder of the German squadron fled. Though considerably battered, all the British machines returned to their base.

Altogether yesterday the British, at the cost of two of their own machines, destroyed four hostile 'planes, threw five out of control and shot down two more by gunfire.

Paris reports three German aeroplanes brought down by French fliers and an other by gunfire. In a raid on Hagondange 8,500 kilograms of projectiles were dropped on stations, barracks and factories, causing extensive fires.

Berlin declares that the Allies lost fourteen aeroplanes yesterday and two captive balloons.

London, May 2.—In the House of Lords today the the Archbishop of Canterbury raised the question of the recent bombing of Freiburg by French and English aviators in retaliation for outrages perpetrated by the German fleet. The Archbishop declared there was a strong feeling throughout the entire country against such reprisals.

Earl Curzon, member of the War Council, replying for the Government, said that after the "abominable outrage" against the hospital ship Asturias, the War Cabinet had decided to execute the threat of reprisals made in January.

"We consulted the French upon the matter," Earl Curzon continued, "and they heartily approved of the plan, and expressed a desire to co-operate. It was then decided to carry out the bombing raid on Freiburg. The Government, however, consulted the Imperial War Conference, which also concurred, and it was also decided that no reprisals would be undertaken after this if the Germans ceased their attacks on hospital ships."

It was too early, Earl Curzon added, to say whether the reprisal had been successful, but there was evidence that it had a salutary effect. He said the French had announced they would put German prisoners on their hospital ships.

An official British Admiralty statement issued on April 16 said that in consequence of German submarine attacks on British hospital ships a large squadron of British and French aeroplanes had carried out a reprisal bombardment on the previous Saturday on the German town of Freiburg, and that many bombs had been dropped with effective result.

The following day the Berlin War Office said eleven persons had been killed and twenty-seven injured in the air raid. Among the dead were seven women, three men, and one soldier. Seventeen women, eight men, and two children were wounded.

The Admiralty announces that the British steamer Gena, 2,784 tons, was sunk May 1 by a torpedo discharged by a German seaplane off Adelburg (Suffolk, England). All hands were saved.

Another seaplane concerned in the attack was brought down by the gunfire from the Gena and its crew made prisoner.

Berlin (via London), May 2.—An official statement issued to-day says:

‘A few seaplanes attacked on Tuesday morning enemy merchant ships before the Thames and sank a steamer of about 3,000 tons. One of our machines failed to return and is supposed to have been lost."

A compilation from British, French and German official communiques shows that 717 aeroplanes were shot down on the western front during April.

The Germans lost 369, the French and Belgians 201, and the British 147. This is a great increase over the casualties for any similar period. The highest previous total was 322 during last September.

ITALY

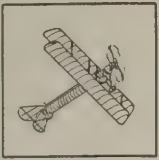
London, May 3.—The Italian War Office issued to-day the following report:

On the whole front there were the usual artillery actions yesterday and somewhat greater activity on the part of our patrols, which engaged in minor fights. Last night enemy aviators dropped bombs on the training establishments and dwellings at Codigoro. One of our aerial squadrons renewed the bombardment of the military works at Opcina and Prosecco. A squadron of six aeroplanes dropped ten bombs on Avlona (Albania) without causing casualties or serious damage.

JAPAN

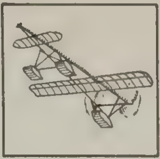
The Imperial Aviation Association's biplane of a smaller type which was under construction at Tokorozawa has been completed. The construction of this new aeroplane, which is the design of Mr. Y. Ozaki, son of the ex-Minister of Justice and airman belonging to the said Association, was started on account of the handsome donation amounting to 10,000 yen of Mr. Soga, stock broker in Osaka, and has been christened "Soga," after the name of the donor. The "Soga" 'plane is equipped with Mr. Shimatsu's 90 h.p. engine and can make 70 miles an hour. It will be remembered that in order to encourage the construction of home made motors, the Imperial Aviation Association some time ago offered a first prize of 20,000 yen, and Mr. Shimatsu's motor has been allotted premier place. Mr. Ozaki will pilot the machine, the trial flight of which is reported to be made in Osaka about the middle of this month.

One of the large reconnaissance machines used by French Flying Corps



MODEL NEWS

Edited by G. A. Cavanagh



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Oxford, Pa.

Bulletin, Broadway Model Aeroplane Club of of Baltimore, Md.

Mr. W. H. Logue, Jr., 931 North Broadway, Baltimore, Md., has offered a set of prizes for a series of model aeroplane contests, to be held at a date to be later announced. Trophies of various kinds will constitute the prize list—cups, banners, medals, and gold coins of $5, $10, $20 cash. Awards will be for distance and duration. It all depends on the interest and enthusiasm aroused, and all club members are urged to spread the news so that entries can be secured at the earliest moment. Any young man in the State of Maryland is eligible to compete. No charge of any kind will be made. The only requirement is that any person desiring to enter the contest build and fly a model aeroplane that he has constructed himself. Show your ingenuity and take a chance at the latest and greatest sport in the world. Use your own ideas and you may help to revolutionize the art of flying. It is great sport and it brightens the brain. Until you try you can't tell whether you are an American eagle or only an English sparrow, so take a chance and try your wings and see. Mr. Logue also offers to pay all expenses of a trip to New York so that some Baltimore boy can compete with the delegates from other clubs that will enter model aeroplanes in the National Contest. An opportunity to enjoy the greatest sport in the world today, and an acquaintance with the brightest boys in Maryland, is something that you should take advantage of, especially as no expense is incurred. Communicate with Mr. W. H. Logue, Jr., 931 North Broadway, Baltimore, Md. Telephone Wolfe 2338 direct, or C. Howard Black, secretary Broadway Model Aeroplane Club of Baltimore, Md., for further information. Send name and address for later bulletins. Tell your friends.

The Indiana University Aero Science Club

The first business meeting of the Indiana University Aero Science Club was held on Friday evening, April 27th. Twenty-two members were present and about a dozen visitors. Mr. Tobias Dantzig of the Department of Mathematics was elected president, and Mr. B. Shilling, secretary-treasurer.

Mr. Dantzig, who for a year worked in the Ecole Supérieure d'Aëronautique of Paris, will offer a course in elementary aeronautics. The members of the club will be grouped into teams of five and each team will undertake to construct a scale model of an aeroplane of standard type. Flying contests will be held before commencement.

The Triangle Model Aero Club

At a recent meeting of the Triangle Model Aero Club of Baltimore, Md., the following officers were elected: Mr. Arthur Waugh, president; Mr. John White, vice-president; Mr. Hurburt Collier, treasurer; Mr. Charles G. Crockett, secretary.

It was also decided at the same meeting that all contests would be held at the Trial Grounds, Colgate, Baltimore, Md.

Every member has pledged his heartiest desire to co-operate in the interest of the club and the advancement of the science of aeronautics in general. Any young man in the neighborhood of our club who is interested in aeronautics and who feels that he would like to associate with us and work for the cause, just drop a line to Mr. Charles G. Crockett, Secretary, Colgate, Baltimore, Md. All applications for membership will be given prompt consideration.

Kites

That Mr. Samuel F. Perkins, of Boston, the veteran pioneer kite flyer, is as active as ever in the interests of kite flying is evidenced by a report in the *Official Gazette* that a patent for a new type of kite has just been granted Mr. Perkins.

In communicating with Mr. Perkins concerning this new and interesting kite he replied stating that in the very near future he would send us a complete detailed description of his new invention for the benefit of our readers.

There is hardly an aeronautical enthusiast in the country who does not know of Sam Perkins and his kites and the presentation of the description and photograph of his new kite will doubtless be of interest to all.

Mr. Henry Villard to Offer Another Trophy

Mr. Henry Villard, who donated the trophy for mechanical driven models which was contended for during the past two years and which was won both times by the Illinois Model Aeroplane Club, is again anxious to stimulate interest in the mechanical driven model, and will offer another trophy.

Just what the plans for the contest will be have not yet been decided upon, but there is an indication that the competition will be open to all.

Full details of the contest will be published in a forthcoming issue.

Another indication of model activity in the West. Here we see the members of the Model Aero Club of Nebraska lined up with their models just after they held their first contest. Dr. F. C. Buck, of Lincoln, Nebraska, is in a large measure responsible for the rapid progress made by the members of this club and through his assistance it is quite possible that many interesting model events will take place in this city

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Extra Precautions

Captain—Well, Lieutenant, I would like to know what you do in these times to see that our men get nothing but the purest of water to drink.

Lieutenant—Well, Captain, first we boil it.

Captain—Excellent!

Lieutenant—Then we filter it.

Captain—Very good!

Lieutenant—Then we distill it.

Captain—Very good, sir, I congratulate you!

Lieutenant (aside)—Then we drink beer.

Valiant Six-Hundred!

President of the Electric Light Company, making his annual Fourth of July oration in the town hall—"I can not understand how people can joke about our light company. Think of the benefits we give to the people. Think of the light, heat and power we furnish. Why, in fact, you could not do without us! If I may use the words of the immortal Tennyson, 'Honor the Light Brigade!'"

Voice from the back—"But think of the charge they made!"

Further Advice for Aeroplane Enthusiasts

1. Make it a rule to ask the busiest man in the shop your questions. He is so overworked that it will be good for him to rest awhile and answer your questions.
2. Ask the designer to let you have a look at his latest blue-prints. When you see them, look them over and tell him that you don't think they amount to much.
3. Assist the workmen all you can. If you see one of them that isn't doing his work right, tell him so, and he will appreciate it.
4. Don't let any signs saying to keep out, bother you. They were not put there for you. You are always welcome.
5. Go up to the chief engineer and lay your latest invention before him. Even if you haven't worked it out yet, tell him the general idea.
6. Above all, if you represent a magazine, solicit advertising just when they are busiest. They like to spend their money, and you might as well get it as anyone else.

Hashimura Outdone

We resign forevermore any thoughts we may have possessed that we could write Japanese dialect. With Wallace Irwin as a model, we have dabbled with Hashimura Togo, and were actually beginning to believe that our stuff was fairly funny. *BUT*. We will quote directly from *The Aeronautic World* of Tokyo, Japan, with the final word that, in our opinion, the writer could not have been any funnier if he had sat up all night practising.

AVIATOR TATEISHI RETURNED HOME

The licensed aviator Mr. S. Tateishi, who had returned from America recently made a flight in Owari prefecture on the 3rd of March. When he fly up about 50 meter some trouble occured in the machine and fell on the ground. He briskly jamped off from the seat an could fortunately landed uninjured. He will made the greatest cross-country flight in Japan shortly.

THE GRADUATION FLIGHT OF THE ARMY

The graduation flight was held on the March 1st at 7.35 a.m. Left. Matsuoka by M.F. 31, Sub-left Kamiya by M.F. 43, and Sub-Left. Wada by M.F. 44 left the Tokorazawa aerodrome and arrived at the Mizurbari ground in Mito at 9.18 a.m. In the afternoon they returned to Tokorazawa.

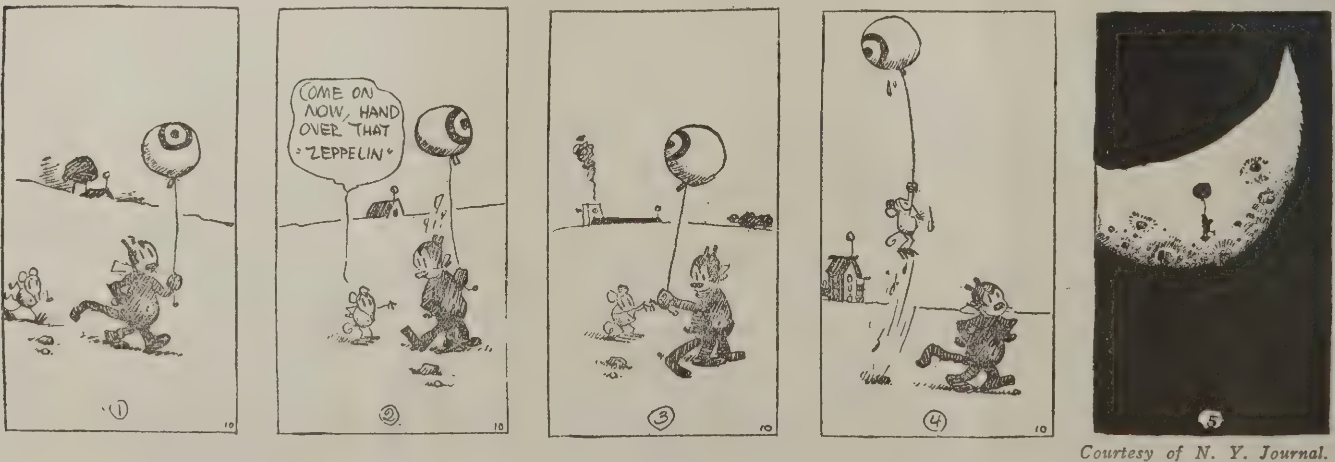
The 2nd of March, at 7.38 a.m. Left Watanabe by M.F. 31, Sub-Left. Noda by M.F. 43 and Sub-Left Hishinami by M.F. 44, started to Mito with a minute interval, 9.40 Sub-Left Noda and reached the destination at 9.23. (*Some traveling! They left at 9.40, and arrived at 9.23!*—ED.) M.F. 31 drived by Left. Watanabe, on her way back the machine missed fire from the engine and he was obliged to descend to the field. The machine was disconnected and brought back to Tokorazawa by train.

(By this it would seem that every one had a perfectly splendid time except the unfortunate driver of the machine which missed fire from the engine.)

Important Note

To tell the truth, we could not think of anything sufficiently funny to insert in this space, and rather than perpetrate on our readers anything other than the funniest of the funny, we have hit upon a plan. We hope that by some measure it will prove feasible. This is it:

Think of the funniest joke you have ever heard in all your life, and then imagine that you were looking at it in this space for the first time. And if your joke is really funny, you will laugh your head off. No?


①
COME ON NOW, HAND OVER THAT "ZEPPELIN"
②
③
④
⑤

Courtesy of N. Y. Journal.

THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

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WILSON CABINET COMPANY
NASHVILLE, TENNESSEE

(*Continued from page* 293)

be made with satisfactory rigor unless the average velocity of the wind is at least equal to 2 meters (6.56 feet) per second.

A car of the same type as the preceding, but more robust, serves for the study of an entire aeroplane. These experiments, still in an introductory stage, have been carried out on a two-passenger machine of the Blériot type. The characteristics of this monoplane are as follows:

Tail plane (pigeon tail).
Span, 11.10 meters (36 feet).
Length, 9 meters (29.5 feet).
Surface of the wings, 25.35 square meters (272.8 square feet).
Angle of the chord of the wings with the tail plane, 6°.

The ensemble of this apparatus was studied for three positions of the depth rudder:

(*a*) Rudder in the prolongation of the tail plane.

(*b*) Rudder turned 18° downward with reference to the tail plane.

(*c*) Rudder turned 51° upward with reference to the tail plane.

Experimental speeds 15 to 18 meters (49.2 to 59 feet) per second (54 to 65 kilometers (33.5 to 40.4 miles) per hour).

A special car serves for the study of propellers.

The propellers are full sized. They are mounted on the special car which they serve to propel. This car carries a framework which makes it possible to carry the propeller at a distance from the car itself and to operate the propeller as though it were placed in an indefinite medium. On the car is an 80-horsepower motor which operates the propeller shaft by means of a transmission similar to that which is found on dirigible balloons.

The axles of the car are free and the speed of the car is due solely to the pull of the propeller. A lever brake is provided which is applied by the operator who rides on the car. This brake is, furthermore, similar to that which is used on the car for testing surfaces. The control of the car is carried out from an operating cab similar to that for the car previously described.

The return of the propeller car is obtained by running the propeller backward at reduced speed in order to avoid undue strain. The pull of the propeller is measured by means of a dynamometer inserted between a movable bar articulated at its base and the fixed framework of the car.

The power absorbed by the propeller is measured in two different ways:

(*a*) By means of a wattmeter registering the electric power required by the motor.

(*b*) By means of a transmission dynamometer registering the couple required to drive the propeller.

These two pieces of apparatus are standardized by means of a Renard brake, which is attached to the shaft in place of the propeller.

The velocity of the car is determined by the same two methods as above noted for investigating surfaces.

The number of revolutions of the propeller is measured by means of a registering counter.

The relative velocity is obtained by making a correction for the wind, the same as in the case for surfaces.

The velocities realized have not exceeded 20 meters (65.6 feet) per second.

The Aerotechnic Institute has undertaken to make a series of tests on aeroplanes in free flight.

M. Toussaint, assistant director of the institute, has carried out the following investigations:

First, on a Maurice Farman biplane, piloted by Capt. Etévé.

Second, on a Blériot monoplane, piloted by Lieut. Gouin.

The following items of equipment were installed:

(1) A recorder of relative velocity giving the speed of the aeroplane relative to the air.

(2) A registering wind vane giving the inclination of the wind to the chord of the planes.

(3) A registering clinometer giving the longitudinal inclination of the aeroplane relative to the horizontal.

(4) A registering barograph, very sensitive up to 500 meters.

(5) A registering revolution counter giving the speed of the engine.

(6) A register of the movement of the depth rudder.

(7) A register of the warping of the planes.

All these registering instruments, except the revolution register, are provided with cylinders of such proportions as to give a length of diagram of 292 millimeters (11.5 inches) in 26 minutes—that is, 11.2 millimeters (0.442 inch) per minute. With this velocity of movement of the record one may judge the periods of steady conditions exceeding 10 to 20 seconds duration. Quantitative measures can not be properly drawn from periods of steady condition having less than this duration.

In order to assure a perfect agreement in time between the different diagrams, or, in other words, in order to be perfectly sure that the points taken as corresponding do indeed relate exactly to the same instant of flight, each register is provided with a supplementary pen moved by an electromagnet. Throughout the course of the flight the pilot by closing the circuit at sufficiently close intervals causes these pens to register simultaneously on all the diagrams.

The reference points thus traced are all in synchronism, and thus provide an assurance of perfect accord for measurements made in the vicinity of these points.

In order to protect the instruments from vibrations and shocks, they are provided with elastic suspension in their cases.

We shall not enter into the details of the description of these various instruments. We note simply that the register for velocity relative to the air, as well as the direction vane, should be placed in such manner as to avoid the turbulence produced by the propeller, the planes, and the body.

The register for the movements of the depth rudder and for the warping of the planes was installed on the Blériot. This gives on one cylinder the movements of the handwheel barrel. It comprises simply a system of axes with tracing points, parallel between themselves and perpendicular to the axis of the registering cylinder. Each one of these axes carries, on the one hand, a lever connected to the barrel by a wire, and, on the other hand, a stylus or marking pen. A return spring fixed on the lever serves constantly to maintain the wire under tension. This wire is attached to the barrel at the same point as the cable which operates the corresponding control; it passes over little pulleys and is thus carried to the register. The movements of the stylus for the position of the barrel corresponding to horizontal flight and to various inclinations of the depth rudder are marked on the register, the axis of the propeller in repose being horizontal. Similarly reference marks are determined in repose for the movements of the stylus registering the warping movements of the planes. In the apparatus of the institute the needle rises when the barrel is carried to the left; it descends when it is carried to the right.

The Aerotechnic Institute possesses also an installation for the study of small models by means of a fan. The fan absorbs 120 horsepower, providing for a flow in an experimental section of 2 meters (6.56 feet) diameter of a current of air of 40 meters (131.2 feet) per second or 144 kilometers (89.4 miles) per hour. The total delivery amounts to 125 cubic meters (4,412 cubic feet) per second. This apparatus is under trial.

There is also at the Institute of Saint-Cyr a covered installation for the study of small models. The diameter of the rotunda is equal to 38 meters (125 feet). The turning arm is about 16 meters (52.5 feet) in length. The velocity at the extremity is 90 to 95 kilometers (56 to 59 miles) per hour.

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The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

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THE ERIE SPECIALTY COMPANY

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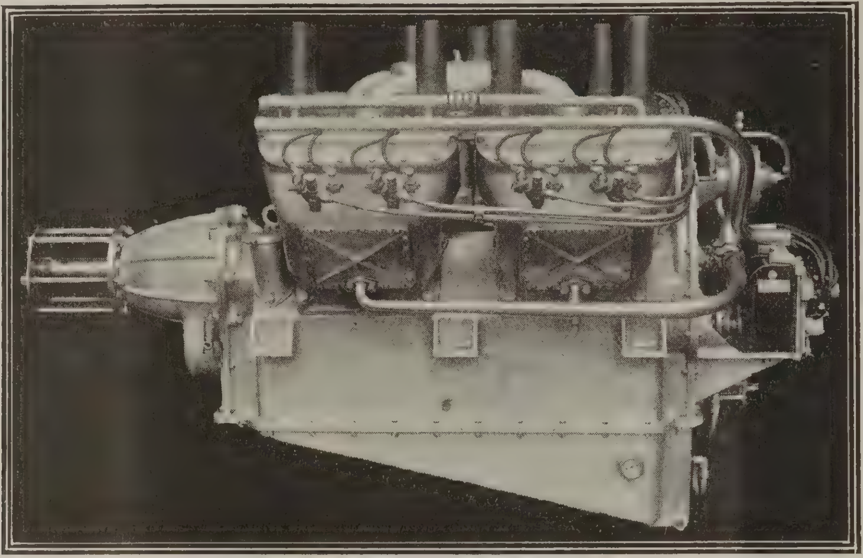
the desired result. The users of Erie Standard Aircraft Parts are assured of a product complying fully with any government specifications.
(Send us your requirements, and we will submit estimates and delivery dates.)

ERIE PENNSYLVANIA



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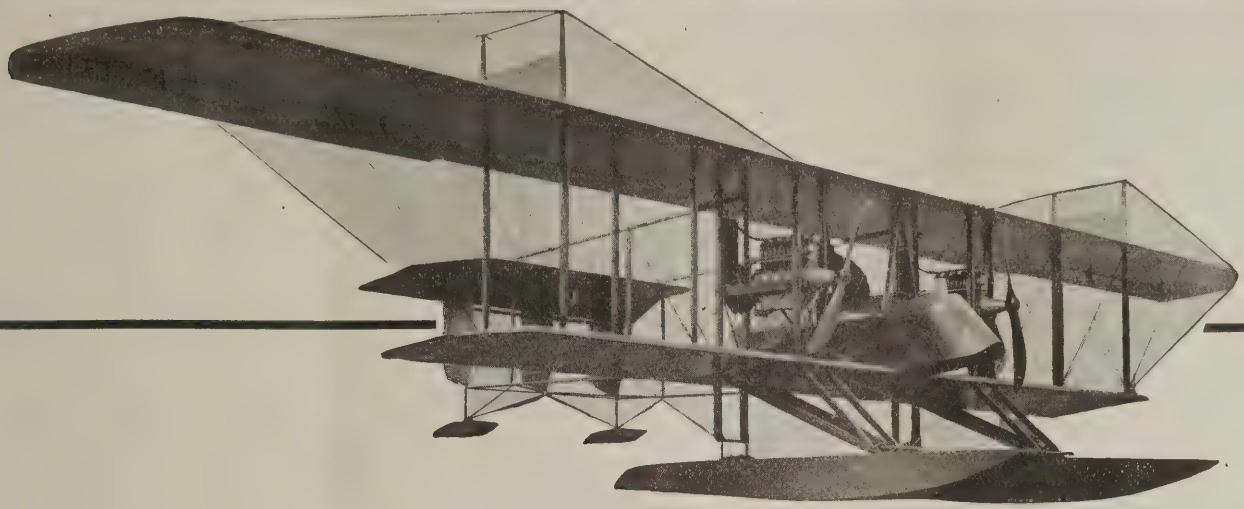

PERFORMANCE

The New York Aero Construction Company's Twin Motored Seaplane has a maximum speed of 85 miles per hour, excelling the estimate by ten miles per hour. Yet it has a slow landing speed of 43 miles per hour, allowing the landings to be made within a much smaller space than is ordinarily the case. But what is even more important in coast defense work is the fact that it has a

FLYING RADIUS OF NINE HOURS

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820 Sq. Ft. Supporting Surface.
Two 100 H.P. Aeromarine Motors.
Weight 2,700 lbs. Useful load 1,700 lbs.

Maximum speed, 85 Miles per hour.
Minimum speed, 43 Miles per hour.
Flying radius, nine hours.

Designed and constructed throughout under the supervision of Mr. Warren S. Eaton.

NEW YORK AERO CONSTRUCTION COMPANY, Factory, Newark, New Jersey

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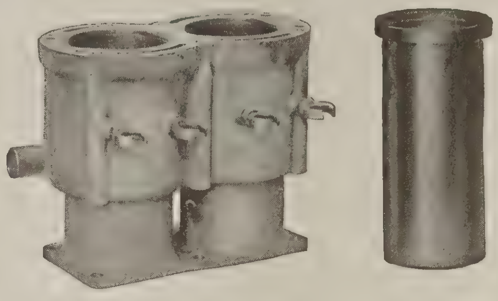

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CYLINDERS AND SLEEVE

The aluminum cylinders are cast in pairs and are carefully fitted with removable steel sleeves.

These two features contribute largely to the lightness and endurance of Sturtevant Aeronautical Engines.

B. F. STURTEVANT COMPANY
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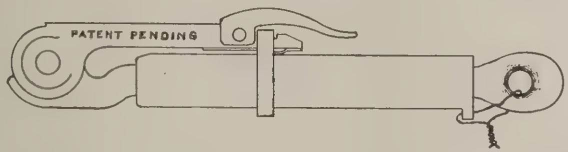
The Bellanca Turnbuckle

A Labor and Time Saving Invention

The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

From the description above given, the advantages of the *Bellanca Turnbuckle* over all other types will readily be seen and appreciated.

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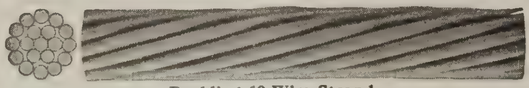

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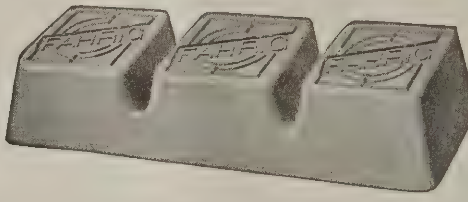

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FOR SALE: 60 H. P. CURTISS MACHINE, just overhauled and in perfect condition. Also a 60 H.P. Curtiss engine as good as new; will sell either or both.

$5.00 PLANS, $2.50 FOR LIMITED TIME, or Star and Junior tractors with Nieuport Speed Scout $5.00. Engineering Course. Everything aeronautical. Chicago Aero Works, 326 River Street, Chicago, Ill.

FOR SALE: FUSELAGE, WINGS, ELEVATOR and rudder of monoplane. Cheap if taken at once. Also good motor. Write to George Gaylor, Clearfield, Penna.

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One of the most comprehensive books dealing upon the subject of model aeroplanes and their motors. The book includes a short history, a complete description of a simple model, World's record Models, compressed air, steam and gasoline engines, models driven by such engines, world's records and a list of definitions of aeronautical words and terms. Price Net $1.00, Aerial Age, 280 Madison Avenue, New York City.

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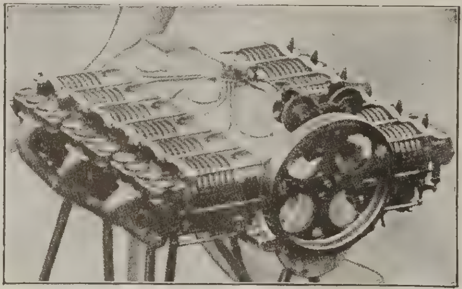

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for **CONTINUOUS HEAVY DUTY.**

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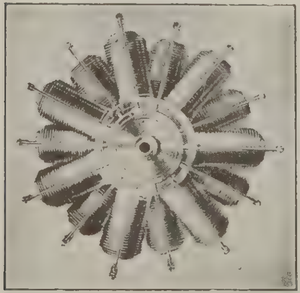

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PRICES ON APPLICATION

All price quotations withdrawn. There has been a rise of ten to twenty-five dollars per thousand feet on all classes of this lumber during the last thirty days, and the probabilities are that the grade 3 inches thick and thicker, 6 inches wide and wider, ten per cent; 10 to 17 feet long, ninety per cent; 18 to 40 feet, seventy-five per cent vertical grain, **four sides clear** straight grain, not less than ten annular rings to the inch, will be $200.00 per thousand f. o. b. New York within sixty days. Many foreign buyers are on the Pacific Coast and are taking all offerings. It is advisable to place contracts at once for a season's supply before the price rises further or the grade is exhausted. No aeroplane spruce older than 4 to 6 months is available and spruce should be air dried nine months and longer to achieve the best results. In purchasing, care should be taken to buy from a specialist the grade known as **four sides clear, free from all knots and sap pockets.** Some aeroplane builders not conversant with these specifications have made purchases which were practically valueless for construction work.

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REMARKABLE NEW AEROPLANE DOPE AND REAL FIRE-PROOF PAINT
that meet every standard requirement, and in addition

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This remarkable new Dope, besides being absolutely fire-proof, will by our process render your plane fabrics

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Oil and gasoline spilled or splashed on plane surfaces, if ignited by engine backfire, cannot burn fabrics treated with our new dope—the fire cannot touch the fabric and will not spread beyond the oil covered area.

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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed **without in any way affecting** the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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With the Allied Forces in the Balkans.
A Lewis Machine Gun in action against
a hostile aeroplane

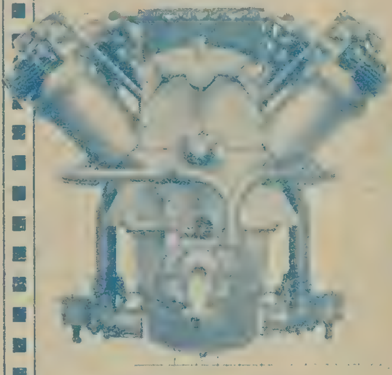
U. S. Senator BRADY: "Have we developed a first-class type of machine gun?"

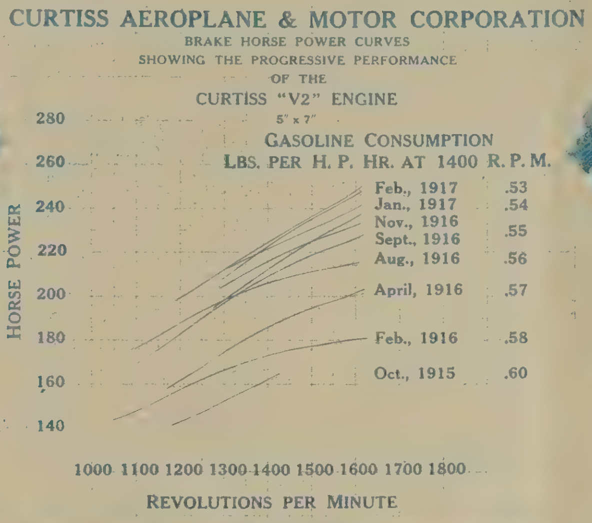
Major-General LEONARD WOOD: "The Lewis gun has been adopted practically unanimously as the light gun of the British service and is being built for the French; and I think it is safe to say, when you see great nations struggling for life adopt a gun, that they are not adopting it lightly."

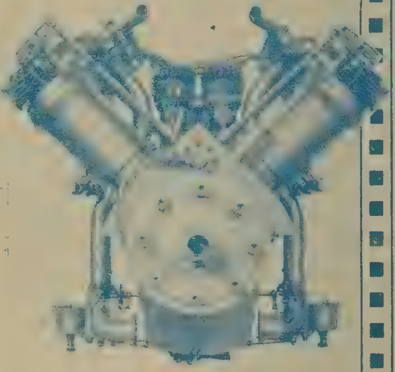
Transcript from the hearing before the U. S. Senate Military Committee, January 31st, 1917.
From Army and Navy Register

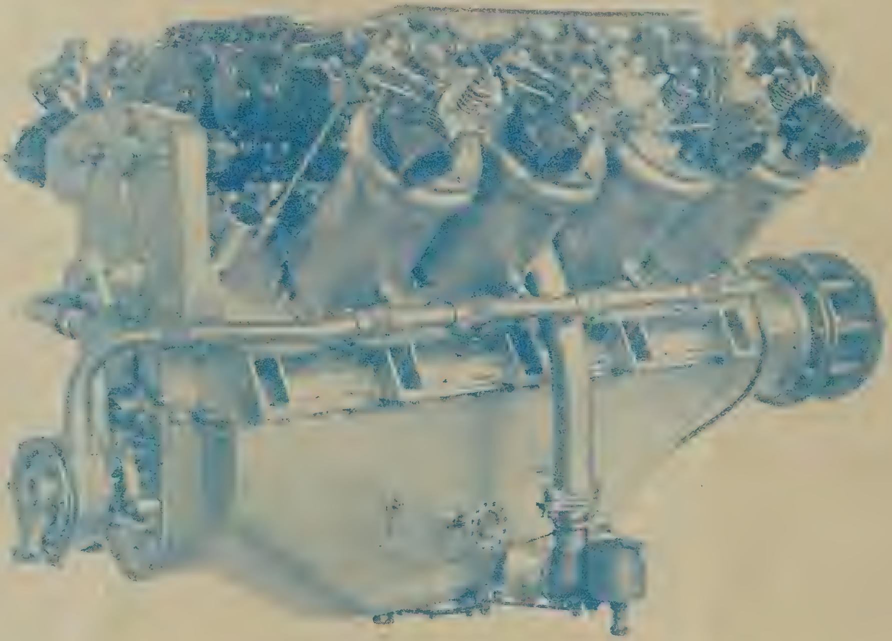
SAVAGE ARMS COMPANY

Executive Offices: 50 CHURCH STREET, NEW YORK
Plant: 1671 SAVAGE AVENUE, UTICA, NEW YORK









Curtiss

The motor shown above is a Curtiss 8-cylinder, Vee, 4 stroke cycle, rated at 200 H.P. at 1400 R.P.M. Double ignition, two high tension—8-cylinder magnetos. Water cooled—centrifugal pump. Oiling, force feed to all bearings. Weight, with propeller hub, 72[illegible] pounds. Full information and installation dimensions gladly furnished on request.

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BUFFALO, N. Y.

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Aeronautics
MAY 21 1917

AERIAL AGE WEEKLY

Vol. 5, No. 10 MAY 21, 1917 10 CENTS A COPY

Instruction Machines of the U. S. Army Somewhere in America

Army Has $65,000,000 for Aeronautics—$125,000,000 Required to Carry Out Plans

A Lewis used as an anti-aircraft gun masked in wheat field
Official photograph (Crown copyright) taken on the front in France

"MODERN Warfare has developed a real necessity for machine guns both light and heavy, but as far as I saw, the Lewis Gun far outnumbered all other machine guns of the light type among the Allied armies.

"In the last engagement I saw in the recent Somme offensive, whole detachments were going into the trenches with every man carrying a Lewis Gun as one would carry an ordinary rifle."

WILL IRWIN
(War Correspondent, Saturday Evening Post)

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Executive Offices: 50 CHURCH STREET, NEW YORK
Plant: 1671 SAVAGE AVENUE, UTICA, NEW YORK

THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

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Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities

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AERIAL AGE
WEEKLY

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THE TRADE AUTHORITY
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Subscription Price, $4.00 a year, Foreign, $5.00. Telephone, Murray Hill 7489

VOL. V NEW YORK, MAY 21, 1917 No. 10

ARMY HAS $65,000,000 FOR AERONAUTICS—$125,000,000 REQUIRED TO CARRY OUT PLANS

CONFIRMING the recent reports printed in AERIAL AGE regarding the large appropriations for military aeronautics, the *Army and Navy Journal* says editorially:

"While the efforts of the Signal Corps for the time being will be directed entirely to the problem of supplying the forty-eight aero squadrons and eight balloon companies to complete the tactical composition of the first Citizen Army, it is learned that work already is under way on a three-year program which will call for at least 2,500 trained aviators and a ready-for-use air fleet of 3,700 'planes. Tentative estimates show that $125,000,000 will be required to carry out these plans. The Signal Corps, however, have available today not less than $65,000,000 to be expended on aviation and no doubt is felt on the question of getting as much more in the next two years.

"Absolute assurances have been given Brigadier-General George O. Squier, C. S. O., that sufficient training machines will be ready when his student forces are gathered. The question of fighting aeroplanes is a more weighty one and *it is more than probable that the equipment of the aviation force sent to Europe will come from French factories.* The statement that no American model has yet been found that is equal in every way—speed, endurance and general flying capability—to the demands of modern air fighting, remains unrefuted so far as we can learn. British experts candidly told our aviators that their machines are too small and too slow for either reconnoisance or raiding. Recent unfortunate accidents to our student-aviators indicate even graver troubles.

"Major Tuslane and Lieutenant de la Grange, two French army aviators, have reported to General Squier with a view to offering their services in the work of building up the American aviation service. The visiting officers have been assigned desks in the office of the C. S. O. and were in daily conference with him.

"Authority has been given for the organization of the 1st and 2d Reserve Aero Squadrons at New York City and Philadelphia, respectively. The commanding general of the Eastern Department was instructed to complete these units by the assignment of officers and enlisted men from the Aviation Section, S. R. C."

We do not agree with the *Army and Navy Journal* in its conclusions regarding American fighting machines and refer this contemporary to the recent reports regarding the comparative efficiency of European and American machines. We can supply aeroplanes equal type for type to the best European machines, and heartily hope that the authorities will not lose this opportunity for creating greater sources of supply.

To place orders in Europe for aeroplanes to be used by American aviators is not only a case of adding work instead of helping our Allies, but it leads to shirking our duty, which is to develop and supply aeroplanes equal to the very best European products.

The temper of the country at present is not such that it will permit shifting on our Allies responsibility which we should assume ourselves, or failing to promptly take steps to create adequate sources of supply in this country for such necessary instruments of war as fighting aeroplanes are. If it should happen that our Allies should have a more efficient machine in any given type, then it is the duty of our authorities to secure these designs and make them available to our manufacturers. In the meantime we should supply our Allies with a large number of machines of the type which they are using and need in large numbers for submarine hunting. The American machines of this type are superior to the European and the Allies need many. Let us begin by solving the most pressing problems and act promptly.

F. H. RUSSELL ELECTED PRESIDENT OF AIRCRAFT MANUFACTURERS' ASSOCIATION

MR. F. H. RUSSELL, the veteran aeroplane manufacturer, manager of the Burgess Co., was elected president of the Aircraft Manufacturers' Association at its regular monthly meeting, which was held on May 9 in the offices of the Association, 501 Fifth Avenue, New York.

The following were present at the meeting: Aeromarine Plane & Motor Corp., represented by Mr. Inglis M. Uppercu; Burgess Company, represented by Mr. F. H. Russell; the Curtiss Aeroplane and Motor Corporation, represented by Mr. Fay L. Faurote; L-W-F Engineering Co., represented by Mr. A. H. Flint; Standard Aero Corporation, represented by Mr. Harry B. Mingle; B. F. Sturtevant Company and the Sturtevant Aeroplane Co., represented by proxy; Thomas Morse Aircraft Co., represented by Mr. H. B. Morse.

Election of officers was held and the following were elected: Honorary President, Glenn H. Curtiss; President, Mr. Frank H. Russell, Burgess Company, Marblehead, Mass.; Vice-President, Mr. Albert H. Flint, L-W-F Engineering Co., College Point, L. I.; Treasurer, Mr Inglis M Uppercu, Aeromarine Plane & Motor Co., New York City; Secretary, Mr. Benjamin L. Williams, New York City; Assistant Treasurer, Mr. A. H. Flint.

Mr. Russell succeeded Mr. H. B. Mingle, the provisional president, who resigned.

Resolutions of appreciation for Mr. Mingle's past services to the Association were passed, and as a token of the personal appreciation of the members for him, he was presented with engrossed resolutions and a handsome gold watch suitably engraved.

Six committees were authorized as follows:

Advisory Committee: Albert H. Flint, H. B. Morse, Benjamin Foss.

Committee on Patents: Curtiss Aeroplane & Motor Corp. Chairman, Thomas-Morse Aircraft Co., Sturtevant Aeroplane Co.

Committee on Materials: L-W-F Engineering Co. (Chairman), Curtiss Aeroplane & Motor Corp., Burgess Co., Standard Aero Corp., Sturtevant Aeroplane Co., B. F. Sturtevant Co., Aeromarine Plane & Motor Co., Thomas-Morse Aircraft Co.

Membership Committee: Benjamin Foss, H. B. Mingle, Mr. A. H. Flint.

Standardization Committee: Curtiss Aeroplane & Motor Corp. (Chairman), L-W-F Engineering Co., Burgess Co., Standard Aero Corp., Sturtevant Aeroplane Co., B. F. Sturtevant Co., Aeromarine Plane & Motor Co., Thomas-Morse Aircraft Co.

Publicity, Advertising and Censorship Committee: Fay L. Faurote.

Resolutions were passed authorizing the insertion in all advertising of the members the following line "Member of the Aircraft Manufacturers' Association" and a resolution of appreciation for work of Mr. H. B. Mingle, who as president did much to firmly establish the Association in its chosen field. It was also resolved to create a design typifying the aircraft industry to be used as a distinctive mark of the Association. In addition there were a number of other important matters in connection with the industry that were considered, the details of which are not available as yet. The meeting adjourned at 6:30 P. M. to meet again on June 13th.

President Russell does not need introduction to the aeronautic movement. He has been in it since the earliest days, first with the Wrights and then in charge of the Burgess Co. A Yale graduate and a man of remarkable abilities and extensive experience, Mr. Russell is especially fitted to be the president of an organization having such a splendid future as the Aircraft Manufacturers' Association has. Above all, he holds the confidence of all the aeronautic manufacturers and workers who will gladly co-operate with him in the co-ordinating of efforts and resources for the advancement of American aeronautics and the upbuilding and extending of the Association's prestige and power.

LONDON PRESS WELCOMES SUGGESTION TO SEND AMERICAN AVIATORS TO EUROPE

The London press has welcomed the suggestion to send American aviators to Europe. In an editorial entitled "America and the War" the London *Daily Telegraph* says:

"According to our New York correspondent, in the interesting communication which we published on Saturday, it is probable that the first contribution of America to the fighting forces at the front will consist of 'a large, representative and enthusiastic corps of military aviators.' *We hope that prognostication, which was based on statements made by leading members of the Aero Club of America, may be fulfilled at the earliest possible moment. There is, indeed, already at the front a squadron of American fliers, known as the Lafayette Squadron, which for more than a year has shared to the full at Verdun and elsewhere, the perils and glories of the Royal Flying Corps and their French colleagues.* It was announced a few days ago that the members of this squadron had just been officially recognized by the American Government, and would for the future wear American uniforms. It may be assumed, therefore, that the American authorities will keep this squadron for the future up to its full strength, and any additions they can see their way to make will be heartily welcomed. Naturally, there is an eager desire in this country, now that America has come into the war, to have an opportunity of saluting the American uniform, and many people, apparently, seem to think that merely by touching a button an American Expeditionary Army will spring into being, ready to step on board the waiting transports. They remember how instantly three divisions of the British Expeditionary Force were got ready and sailed for France at the beginning of the war, and they seem to expect the United States to repeat the same feat. They forget, however, that it was the settled military policy of Great Britain to have its spearhead ready for instant service in any part of the Empire, whereas the very last thing contemplated by American statesmen and the American military authorities can have been the despatch of an American Army, whether large or small, to fight on the battlefields of Europe. The United States has maintained a regular standing Army small out of all proportion to its population, wealth and power; so exiguous, indeed, that the Germans, accustomed to think of armies in terms of millions of men, regard it as a ridiculously negligible quantity. Doubtless it is in their eyes, but another 'contemptible little Army,' which they need not take into their reckoning, and which, as a matter of fact, they deliberately ignored when they decided to prosecute their submarine policy to the utmost, regardless of whether it led to a rupture with America or not. It is, of course, for Americans themselves to determine what military steps they will take to aid the common cause. They are resolved on raising great armies. They will require the cadres of their Regular Army for the purposes of easy and rapid expansion. Let it be remembered how enormously useful the cadres of our Regular and Territorial battalions were to Lord Kitchener at the beginning of the war, and what use he made of them when he set about raising the New Armies. Our latest Allies are in much the same position as we were then, and, therefore, it is quite certain that they will use their Regular Army as the nucleus of the great new American Army, which, if the war lasts long enough, will help in administering the coup de grace to the common enemy.

"They might, no doubt, send a small force, just to show the American flag at the front. That would appeal magnetically to the sentiment of all America's Allies, and if an American Brigade or Division does cross the Atlantic, as an earnest of the great army which is to follow later, the people of England will welcome it with the same heartiness which they showed to the brigades and divisions of our own Dominions. The notion, however, is rather a sentimental one, and there may be vital military objections to it from an American point of view. Much, therefore, as we should like to see the spectacle of an American Division marching through the streets of London, with the Stars and Stripes flying, and warmly as London's millions would respond to the sight, we shall not be surprised if the American authorities decide not to send any military forces to Europe until they can despatch an army commensurate with the power and authority of the United States. That Army will need to be equipped with is proper quota of flying squadrons, and the aviation establishment of the American Army was until lately framed on a very small scale. The Government, however, recently increased the vote for the aerial service from $300,000 to $3,625,000, and large aviation training camps are being formed, where preliminary training can be given. The officials of the Aero Club told our New York correspondent that applications were pouring in, and that there will be no trouble to get a thousand volunteers to make up American aero-squadrons, like trained battalions, are not be had ready made, simply by stamping on the ground, and we must not expect too much even from the American genius for improvisation and obtaining lightning results. Nevertheless, we hope that the first reinforcements to the Allies from America—apart from such useful aid as may be rendered at sea—will take the shape of aero-squadrons, eager to carry on the fine tradition already established by the Lafayette Squadron. Be the unit what it may, and come when it may, the American fighting uniform will be greeted with rapture in whatever part of the United Kingdom it is seen, and those who wear it will be made to feel that they are among their own people. Anglo-Americans do not disdain sentiment when they meet together at luncheon or dinner and listen to eloquent speeches. Give the mass of Londoners a chance of saluting 'Old Glory,' borne by American soldiers who have come to Europe to fight for Freedom at the side of British and French soldiers, and the enthusiasm of last Thursday will be rekindled at every street-corner."

Checking the Submarine Menace

The submarine menace can be checked by present-day airchaft.

In any discussion of what can be done against the submarine, there must first be stated whether we mean the protection of ships at sea or when they are on coastwise trips. Nothing else could protect the sea lanes so well as large dirigibles, capable, as the Zeppelins are, of cruising for 3,000 miles without stopping.

Unfortunately, no country outside of Germany has large dirigibles for use for this purpose. Had we got them they could be used to patrol the ship lanes daily. No submarine would be safe, no matter where at sea, with large dirigibles patrolling, because large dirigibles carry guns of sufficient calibre to sink a submarine with a single shot. Likewise, the observers from a dirigible, as in the case of an observer from an aeroplane, can see a submarine miles away, when a man from a ship cannot see it, and as the airship travels many times faster than the submarine and the submarine could not easily detect the approach of the airship, the submarine would stand no chance.

Unfortunately, the Allies are far from being in a position to patrol the sea lanes with a large number of airships, although there is a possibility that Great Britain will put some into service within a few months.

The submarine menace can be checked by present-day aircraft—seaplanes, small dirigibles and kite balloons. We are now building large seaplanes which are capable of carrying fuel for continuous flights of over fifteen hours and capable of going at a speed of over seventy-five miles an hour. American manufacturers have supplied quite a number of large seaplanes of this type to England, and, as Mr. C. G. Grey, the editor of the "London Aeroplane," has pointed out, "If America is seriously perturbed about the fate of American shipping and American citizens traveling by sea, it should not be a difficult matter for America to rig up in a very short space of time quite a fleet of aeroplane carriers suitable for handling these big seaplanes."

What different types of aircraft can do in hunting submarines is told in the advance page proofs of a chapter from the forthcoming text-book on Naval Aeronautics by Henry Woodhouse, being published by the Century Cmpany, of New York, which is extensively illustrated.

THE NEWS OF THE WEEK

Aeronautic Legislation in Appropriation Bill

The Army Appropriation bill, H.R. 13, contains the following provisions of new law:

Aviation—Not more than $10,800,000 of foregoing appropriation ($11,800,000, Signal Service) shall be used for the equipment of buildings, supplies and expenses of the Aviation Section, and for paying officers and enlisted men of the Reserve Corps of the Aviation Section called into active service, development of a suitable type of aviation motor, and for investigations to be made by and technical instruction of commissioned and non-commissioned officers of said section.

Hereafter motor-propelled vehicles, aeroplanes, engines and parts thereof may be exchanged in part payment for new equipment.

The Secretary of War is authorized to acquire, by purchase, donation, or by condemnation, such land sites throughout the United States as are immediately necessary for permanent establishment of aviation schools, aviation posts, and experimental aviation stations and proving grounds for the Army.

In order to carry this legislation into effect the Secretary of War is authorized to use portion necessary of $13,281,666 appropriated for Signal Service in Army Act of Aug. 29, 1916, provided that not more than $4,500,000 shall be made available for this purpose. The funds thus authorized for purchase of land sites may also be used for improvement and preparation of land and waters contiguous thereto; for construction, maintenance and repair of buildings and for equipment and supplies. The funds thus authorized to be available until expended; not more than $600,000 of foregoing sum shall be used for purchase of land; no part of foregoing appropriation shall be expended for purchase of aviation fields if it is found practicable to lease suitable tracts for such purposes on more favorable terms.

Hereafter nothing in Sec. 25, National Defense Act of June 3, 1916, shall be held to prevent detail of an officer in Aviation Section of Signal Corps.

Mileage to officers in Aviation Section, Signal Corps, traveling on duty in connection with aviation service shall be paid from appropriation for work in connection with which travel is performed.

Specifications for Military Pursuit Aeroplanes Issued

The Aviation Section, Signal Corps, U. S. Army, has issued specification No. 1003 covering military pursuit aeroplanes. Hitherto AERIAL AGE has presented the aeronautic specifications in full to its readers, but in view of the possibility of transferring information to the enemy, we merely announce the issuance of these specifications, with the suggestion that manufacturers interested may obtain copies from the Officer in Charge of Aviation, Signal Corps, War Department, Washington, D. C.

Aero Section for Fourth Battalion Naval Militia

J. B. R. Verplanck is co-operating with the officer commanding the Fourth Battalion of the N. Y. Naval Militia and is in charge of the Aeronautic Division. The division has already secured its full complement of men, and it is expected that the mustering in services will be held in the very near future, after which the men will be sent to a navy aeronautic station for training.

In securing the services of Mr. Verplanck, the unit will have advantage of his vast amount of flying experience, and under his guidance rapid progress should be made with the tuition.

630 New S. A. E. Members

New York.—The new membership campaign of the Society of Automotive Engineers is gradually reaching the 1,000 mark, its goal. To date 630 applications for membership have been received, of which forty-one were received this week. The list has jumped from 484 in one week, an increase of practically 200. Should this rate of increase be kept up or bettered, it is possible that the 1,000 mark will be reached by the end of May.

Beverly Farms Citizens Give Beach to Uncle Sam

Boston—The West Beach Corporation, composed of all the citizens of Beverly Farms, turned over West Beach, one of the most exclusive bathing beaches on the North shore, to the government for aviation purposes. Lt. F. F. Lincoln took charge of the property, which includes a long pier and a well-furnished pavilion, with locker rooms and other conveniences. The grounds will probably be used for the naval reserve aviation school.

Mystery Island, which was the site of last year's naval militia aviation school, will undoubtedly be taken over entire this year in connection with the West Beach camp.

Efficiency of American Motors

A very interesting statement concerning the life of an American aeronautic motor, comes from N. B. Robbins, an aeronautical engineer at North Island, California. Mr. Robbins writes:

"The motor I refer to is in machine No. 157-Curtiss Jn used for training by myself. It has now run officially 127 hours. Is now in perfect working order. Turns the propeller now at 1425 r. p. m. I believe I would be safe in saying the average is about 1400 for the type and size engine. Sometime ago a congressional committee visited the school here and we flew in review with about 20 machines. On this trip I piloted my machine without student, and I attained an altitude of 3,700 feet in just seven minutes, this with the motor I speak of and at that time had run about 100 hours. I know that this as above the average. I hope to be able to get 150-175 hrs. from this motor, and from indications it will easily do it. It is some pleasure to train in a machine that is always on the job."

Members of Instructor Vernon's Class Hold Banquet

Memphis—Members of Victor Vernon's class at the United States Aviation Station at the North Memphis Driving Park recently gave a dinner at Hotel Gayoso. Those present were the men who have been turned loose, as the aviators say, after instruction under Mr. Vernon. All are Chicagoans.

Those present were Harry W. Powers, William J. Seleck, R. W. Schroeder, A. E. Wolf, Frank W. Alsip, Victor Vernon, Charles W. Browne, Geo. F. Fisher, Andrew C. Ortmayer and Jack Foote.

New Wright-Martin Stock

New York City.—Stockholders of the Wright-Martin Aircraft Corp. will be asked shortly to approve an increase in the authorized amount of capital stock from 500,000 shares to 1,000,000 shares of no par value. There are now outstanding 400,000 shares, 350,000 having been issued at the time of the company's organization, while 50,000 were sold recently to provide for current payroll expenses. It was announced yesterday that the new issue of 500,000 shares will be underwritten by the interests who organized the company, without commission. The stock, it is understood, will be offered to shareholders at the underwriting price, which may be $5 a share. The new financing will provide the company with approximately $2,500,000 working capital.

Miss Ruth Law in aviator's costume of the U. S. Army. Miss Law is doing excellent recruiting work in Chicago

Aerial Coast Patrol Unit No. 3 Take Oath

The members of the Aerial Coast Patrol Unit No. 3, organized by Clinton D. Backus, a Yale student, took the Federal oath yesterday and were enrolled in the United States Navy. They started training immediately on the estate of J. P. Knapp at Mastic, L. I. The men of the unit are Clinton D. Backus, organizer; Harold Pumpelly, William Connors, Leslie MacNaughton, Joseph Nagel, Harold Howe, Thomas Dixon, Jr., Duncan Forbes, Jack Mitchell, David Dunlap, Edward Thurston and Hamilton Gardner.

Tender Plant to Navy

Seattle, Wash.—Arthur Wesley Davis, the aviator, has formally tendered his aviation plant at Bellingham and his personal services to the Navy Department, and they have been accepted.

Davis is now awaiting further orders. The advice from the Bureau of Accounts and Construction, to which department his offer was referred, arrived last week. The aviation expert is notified to hold himself and his plant in readiness for further instruction.

Several years ago Davis became an aviation enthusiast and attached himself to the Curtiss School at San Diego. After graduating as an aviator, he became an instructor, and served a short time as assistant trainer at the Curtiss establishment.

Westport Needs Money for Aviation Camp

Westport, Conn.—The men behind the recently organized Aviation Camp at Westport have sent out a call for $75,000 for the purpose of carrying out the plan. Their estimate follows:

"To equip a station at Westport will require $75,000. It will cost $22,000 to buy two training machines; $24,000 for the purchase of a real war machine (a hydro-aeroplane mounted with rapid fire guns and the bomb dropping device); one twin screw speed boat for the picking up of aviators who fall into the water, a very necessary part of the equipment of a training camp, at a probable cost of $8,000. It will be necessary to have three extra motors, one motor tow boat, spare parts, tools and equipment, motor truck and motorcycle."

Captain on Aerial Duty

Washington, D. C.—Captain Clarence C. Culver, of the cavalry, was ordered last week to make three trips to Hampton, Va., this month to assist in radio and photographic work with aeroplanes there.

He will assist recruits in use of wireless while flying, and also in use of the telescopic photographic apparatus now commonly applied in aeronautic operations.

Many of the recruits are being trained to air fighting by using the so-called camera rifle. It is a photographic device in which an aviator aiming at another machine pulls the trigger of the apparatus, but instead of firing a shot registers a picture. If the picture of his opponent occurs in the resultant negative, that is equivalent to a "hit."

First Aeroplane Reaches Wheeling

Wheeling, W. Va.—The first aeroplane for the recently organized West Virginia Flying Corps, now established at Beech Bottom, was shipped to Wheeling last week. It will be transported to the training ground at Beech Bottom the first of this week and will be fitted up immediately for use.

Louis Bennett, Jr., organizer of the corps, arrived here from the East, bringing with him F. G. Wegerhauser, Tacoma, Wash.; Nelson Hawkes and T. T. Kent, of California, which will be pupils at the training field.

Two Students in Fatal Accident

Mineola: An escapade in which two mechanics deliberately disobeyed orders by taking into the air one of the instruction machines at Mineola, ended disastrously on May 7, when Private Ransome H. Merritt, and Private Anthony P. Spilener were killed. The two young men, overambitious about acquiring a knowledge of aeroplane handling, took advantage of the fact that they had been ordered to prepare one of the L-W-F biplanes for the day's instruction. Without permission they took the machine into the air and after a half hour's thrilling gyrations one of the wings collapsed and the machine crashed to earth, killing both of the occupants.

Army and Navy News

Major Tulasne and Lieutenant de la Grange, two French army aviators, have reported to General Squier with a view to offering their services in the work of building up the American aviation service. The visiting officers have been assigned desks in the office of the C.S.O. and were in daily conference with him.

Authority has been given for the organization of the 1st and 2d Reserve Aero Squadrons at New York City and Philadelphia, respectively. The commanding general of the Eastern Department was instructed to complete these units by the assignment of officers and enlisted men from the Aviation Section, S.R.C.

Each of the following officers is detailed in Aviation Section of Signal Corps and is rated as a junior military aviator: First Lieuts. William O. Ryan, Cav.; Charles C. Benedict, Jr., Inf.; Harold P. Cousins, Cav.; George E. Stratemeyer, Inf., and Melchior McE. Eberts, Inf. (May 3, War D.)

Capt. Harold S. Martin, junior military aviator, S.C., from duty at Mineola, Long Island, N. Y., to Washington, D. C., office of Chief Signal Officer, for duty. (May 2, War D.)

First Lieut. John G. Colgan, Aviation Section, S.O.R.C., to active duty at Fort Sam Houston, Texas. (May 4, War D.)

Sergt. 1st Class Fred J. Scheidegger, 1st Aero Squadron, S.C., Columbus, N. M., to 3d Aero Squadron, S.C., Fort Sam Houston, Texas, for duty. (April 14, S.D.)

Aviation School for Northampton

Bethlehem, Pa.—At a meeting at the Easton Board of Trade rooms, the Northampton County Aviation Club was organized, with T. A. H. Hay as president and George M. Shook, as secretary. It is proposed to purchase one or more aeroplanes for the use of young men of the county who care to learn to fly. It is likely that the landing place will be the grounds of the Northampton Country Club.

Personal Par

Miss Helen Birkett, daughter of Mr. and Mrs. Clarence T. Birkett, of No. 540 West 122d street, joined the list of war brides May 12. The bridegroom was Torrey H. Webb, young mining engineer, who has just completed a course at the Army Aviation School, at Mineola, L. I. He received orders May 12 to report next day at the aviation station at Newport News, Va.

Aviation Card Party in Brooklyn

On May 7th, Miss Katherine Glidden gave a bridge party at the Hotel St. George for the purpose of raising money "For making the new group of airmen that, to the number of thousands, promise to become important figures of defense in all war conduct in the near future."

Mr. Augustus Post, of the Aero Club of America, gave a very interesting talk upon aviation, and especially on the side of aircraft as a defense against submarines.

Athletes in Aviation Section

Philadelphia.—Two of old Penn's most noted athletes, Ted Meredith and Howard Berry, have gone to Washington to file their papers for the United States Army Aviation Corps. Meredith is probably the greatest of all half and quarter mile runners, and Berry is certainly one of the greatest all around athletes in the history of sport. Meredith's home was in Media, Pa., but he has been living in Philadelphia, while Berry is a resident of this city.

J. B. R. Verplanck, who is in charge of the recently organized aero unit of the Fourth Battalion, Naval Militia

Hotel With Aerodrome Roof

A landing station for aeroplanes is the latest proposal being considered for the Hotel Commonwealth, which is shortly to be built in the Times Square district of New York. The announcement is the more interesting because it carries with it the recognition of the rapidly increasing importance of flying as a mode of travel, and the general belief is that there will be a great demand for such landing stations. The roof of the Commonwealth—which is to be the greatest hotel in the world—will offer excellent facilities for such a purpose, both from the standpoint of size and location.

Standing 28 stories high, the great hostelry will stretch across an entire block-front and will contain 2,500 rooms.

The entire Commonwealth enterprise is unique. The plan is co-operative, the hotel is to be owned and operated by something like 100,000 shareholders, holding from one to ten shares of stock each, at a par value of $100. No one will be allowed to subscribe for more than ten shares. Thus an army of men and women representing every section of the country will be regular patrons of the Commonwealth.

The Hotel Commonwealth will merge hotel and club life, so that the shareholder may enjoy during his stay in the city, the use of gymnasium, swimming-pool, reading, smoking and lounging rooms, indoor golf, tennis, squash and other club luxuries.

Cylinders and Crankshaft Rotate in New Engine

Chicago.—An aviation engine in which cylinders and crankshaft both are permitted to rotate has been developed here by the Muffley Motors Co. and the design is such that it has aroused interest in governmental circles. It is known as the Muffley engine, and at present is designed for ten cylinders approximately 4½ by 5⅛ in. The engine as a whole is similar to the present rotating cylinder engines, such as the Gnome, except that not only do the cylinders rotate, but that the crankshaft rotates in the opposite direction, each at a speed of approximately 1,200 r.p.m. The relative speed therefore is 2,400 r.p.m. The valve action is almost the same as that used on the old Adams-Farwell engine, Glen Muffley, the designer of the new engine, having been instrumental in the design of the earlier motor.

For aviation work two propellers are to be used, one operated by the crankshaft direct, and the other by the cylinders direct, the propellers being of opposite pitch and one behind the other, rotating in opposite directions. Muffley claims that the efficiency is higher than that of two propellers side by side, and very much higher than that of a single propeller. The use of two oppositely rotating propellers in this way is not new, as Captain Baldwin employed this arrangement many years ago in one of his dirigibles. The double rotation engine is also not a new idea, the Root motor, patented in England about 1912, being precisely similar in scheme.

One of the assembly rooms of the Hall-Scott Motor Co., at San Francisco

In Interest of Aeronautics

Friends of Mr. and Mrs. Jonathan Butler, of No. 600 Park avenue, who are especially interested in the aviation cause being fostered by the Aviation Committee of the National Special Aid Society met at the home of Mr. and Mrs. Butler on April 22. Mrs. William Allen Bartlett, chairman of the society, presided.

Those who spoke were Cosmo Hamilton, who has seen anti-aircraft service in the British army; Henry A. Wise Wood and Irvin S. Cobb. Augustus Post discussed the technical side of aviation, and lighter entertainment was given by Miss Janet Beecher, who recited, and Miss Tyson Page, who sang patriotic songs.

Closer Co-operation Between the Hess-Bright and S K F Ball Bearing Companies

In line with plans made last autumn when certain New York interests, including the National City Bank and Messrs. Brown Bros., Bankers, of New York, who were previously interested in the S K F Ball Bearing Co., also acquired an interest in the Hess-Bright Manufacturing Co., of Philadelphia, it is now announced that plans have been perfected for a closer co-operation between these two leading concerns in the ball bearing industry.

The affairs of the two companies will be administered by a recently formed New York corporation, the S K F Administrative Co., of 1 Wall Street. The board of this company consists of Mr. Frank A. Vanderlip, president of the National City Bank; Mr. Thatcher Brown, of Brown Bros.; Mr. F. B. Kirkbride, Mr. S. Wingquist, Mr. Axel Carlander, Mr. Marcus Wallenberg, a well-known banker of Sweden, and Mr. B. G. Prytz, who as president of the S K F Ball Bearing Co. has been active in bringing about the fusion between his company and the Hess-Bright Company. Mr. Prytz has been elected president of the Administrative Company.

Simultaneously Mr. Budd D. Gray, of the Hess-Bright Company, has resigned as president of the Philadelphia company and will become technical advisor to the new New York corporation, which will thus have the benefit of his experience in its various interests. At the board meeting of the Hess-Bright Company on May 8th, Mr. B. G. Prytz was elected to succeed Mr. Gray as president.

The S K F Administrative Company is extending the manufacturing facilities of both the Philadelphia and Hartford plants, and the demand for the company's products continues to be so far in excess of the present supply that it has been considered advisable to immediately make additions both to the S K F and Hess-Bright factories, in spite of the present building costs.

The closer co-operation between the two companies was greatly facilitated by the action of the American Hess-Bright stockholders in buying out the German minority interest in the Hess-Bright Company shortly before the break with Germany, whereby all the stock came into American hands at what is reported to have been a very favorable price for the purchasers.

Fourth and Fifth Aero Squadrons in First Provisional Army Corps, U. S. Army

Major General John J. Pershing, U. S. A., commanding the Southern Department, in which the greater bulk of the U. S. Army is now stationed, has issued important general orders, organizing the troops under his command on a war basis, to be known as the First Provisional Army Corps. The following sections relate to the Aviation Corps:

Departmental Organization.—(The Aviation Department staff officer is yet to be designated.)

Technical and Administrative Staff.—Aviation Officer, Major T. F. Dodd, S.C.

Troops.—Fourth and Fifth Aero Squadrons.

Shops.—At Fort Sam Houston, Texas. Aviation Shops.

Joins Aviation Corps

Jacksonville, Fla.—Walter Hawkins, Jr., son of Walter Hawkins, of this city, who has joined the aviation corps of the U. S. Army, is said to be one of the youngest men who has responded to the call of duty from this city in his respective branch. He is now located at Fort Scriven, near Savannah, where he is being given preliminary training with the other volunteers from this city and the Southern section.

Captain Willoughby Anxious to Serve U. S.

The Navy Department has refused to waive the age limit of 30 years for admission into the flying corps in the case of Captain H. L. Willoughby, and Captain Willoughby will return to Philadelphia after having spent two weeks or more undergoing the severe physical examination for the corps, and upon passing it in trying to secure a waiver.

Sperry Invents Device for Destroying Submarines

Washington.—The New York Sun correspondent despatched a special story May 9th stating that he had learned on "unquestionable authority" that the Naval Consulting Board has submitted to Secretary Daniels and his advisors a definite and completed plan to cope with the German U-boats which has proved a revelation to the best technical brains in the service here.

Strict censorship necessarily bars discussion of any of the technical features of the plan, but it is within bounds to make the following announcement, which should be of the greatest interest to the British and French commissions here as well as to the general public.

The plan is based on a novel anti-submarine device or invention which is theoretically sound and which is a radical departure from any invention put into operation or heretofore thought of.

Elmer A. Sperry, inventor of the gyroscope compass and one of the leading inventive geniuses in the United States navy, is the inventor.

Within two or three weeks the Navy Department will have completed practical tests of the invention under the guidance of naval officers from various technical branches in the service which will show definitely whether or not there is any unforeseen obstacle in the way of putting the invention to use.

The invention is of such a character that it can be put into operation in the war zone almost immediately. It requires no elaborate preparation or construction work, but can be made a factor in the campaign against the U-boat this summer.

Aeroplanes with Pershing Traveled 251,000 Miles

The report of the duration and distance traversed by the aeroplanes with General Pershing in Mexico, has just been made public.

From July 1 to December 31, 1916, the machines of this unit carried mail on one trip in each direction between Colonia Dublan, Mexico, and Columbus, New Mexico, without missing a trip. The average time for this 110 miles was 66 minutes, and the machines were forced to rise to an altitude of 4,100 feet above Columbus and 8,200 feet above sea level. The total flights for this unit from January 1 to December 26 were 7,087. The machines were in the air for a total of 3,356 hours, and traveled a total of 251,775 miles. The fatalities were none.

Aviation Station for Springfield

Springfield, O.—Designation by the War Department of Ohio State University as a training school for prospective Army aviators, with Columbus and Dayton as terminals for the flying course, and Springfield as one of the intermediate stations under the present tentative plans is expected to greatly increase local interest in the military service, particularly the aviation section.

Possibilities seen in the tentative plans for the aviation school for Ohio in establishing one of the important stations in this city has served to stimulate interest on the part of a number of patriotic and public-spirited men in tendering whatever aid the city and its citizens can to the government in the selection of suitable grounds.

Enters Balloon Camp

Holyoke, Mass.—Charles L. Hayward, son of Mr. and Mrs. L. F. Hayward of Brooklyn, but recently of Holyoke, has enlisted for service in the military balloon camp located at Stapleton, L. I. Mr. Hayward will receive his degree from Columbia University in June. He is a graduate of the Holyoke public schools and the Holyoke high school. His cousin, Philip Hayward, has entered the submarine service.

Army School Back to Chicago

Washington, D. C.—The War Department has ordered the army aviation school at Memphis transferred to Chicago, whence it was removed to the Southern city some time ago. "Climatic conditions" is assigned as the reason for the transfer, which was made on recommendation of Major-General Leonard Wood, commanding the Southeastern department of the army.

Aviators Honor Johnson

Memphis, Tenn.—Members of Al Johnson's class at the local government aviation station last week tendered him a theater party. In addition to Mr. Johnson, who is flying instructor, six were in the party which attended the Orpheum.

The men have been turned loose after instruction under Mr. Johnson. By turned loose the aviators mean that students are sufficiently advanced to make solos or flights alone. Those in the party were: Al Johnson, Student Instructor E. P. Hinds, Sergts. Thompson and Showalter, Corporal Jones and Sergt. First Class Chester.

The late Victor Carlstrom, who met with a fatal accident while flying at Newport News, on May 9th

Salt Lake City May Get Aviation Post

Salt Lake City, Utah.—With the passage of the general army bill by Congress, which confers extended power to Major-General Hugh L. Scott, Chief of Staff of the United States Army, Fort Douglas will be established as a brigade post, according to Fred C. Richmond, president of the Salt Lake Commercial Club. Mr. Richmond said that assurance was given him by Major-General Scott that immediately after the Army bill passed Congress Fort Douglas would be converted into a brigade post, and that a regiment now stationed on the border would be sent here to serve as a nucleus.

Mr. Richmond also conferred with Major-General Scott regarding the establishment of one of the Government's aviation stations in Salt Lake; the establishment of a Government warehouse here, and the advisability of having Fort Douglas utilized as a recruiting camp for the intermountain country, where recruits could receive preliminary instructions.

Major-General Scott said that he was exceedingly anxious to see Government aviation and warehouse stations established in Salt Lake, but that the present time was too premature to take definite action.

Victor Carlstrom

The news of the death of Victor Carlstrom will come as a shock to every one of his friends and admirers, and everyone interested in aeronautics in this country was an admirer. The accident, which proved instantaneously fatal, occurred at Newport News, Va., on May 9th, while Carlstrom was taking Carey E. Epes, a student, for his first instruction flight.

The cause of the accident was that owing to the need of hastening the training of the U. S. Army Reserve Corps students, every aeroplane was worked to the limit and the machine used by Carlstrom was practically worn out by continuous use.

Carlstrom was held in the highest esteem as an aviator and instructor. Alan R. Hawley, president of the Aero Club of America, flew with Carlstrom last July at the time of the aviation meet at Sheepshead Bay, when they made their memorable trip from New York to Washington.

"Victor Carlstrom," Mr. Hawley said, "was one of my close friends. I made several trips with him when Carlstrom was the pilot. He had many noble qualities, and without knowing the details I feel sure that this accident was not due to his piloting and must have been such as a skilled driver in an automobile might be subject to. He had a great 'air sense' and was a born cross country flyer, and seemed to know by a remarkable instinct the details of direction. In the last eighteen months we have figured that he had been in the air more than three thousand hours and thought as little of flying as most of us do of taking a motor trip."

Carlstrom established many American records, as follows:

Altitude, an aviator and one passenger, April 30, 1916, Curtiss tractor, 16,225 feet, at Newport News, Va.

Aviator and two passengers, April 19, 1916, Curtiss tractor, 11,180 feet, at Newport News, Va.

Cross country, distance, aviator and one passenger, May 20, 1916, Curtiss tractor, Newport News, Va., to Sheepshead Bay, N. Y., 283.02 miles.

Carlstrom received the Aero Club medal of merit which was awarded at the annual banquet of the club both last year and this year, and he was the winner of the Curtiss Marine Flying Trophy for 1916.

He also received a gold watch from the Aero Club of America for his flight from Chicago to New York, when he made the cross country distance record of 393.585 miles, which was afterward beaten by Miss Ruth Law.

Thorne Donnelley, a young Chicago sportsman, who has been learning to fly in order to join the Aerial Reserves, and has been Carlstrom's pupil, stated at the Aero Club that Carlstrom always allow him to correct his own mistakes. This, Mr. Donnelley stated, gave the student greater confidence and enabled him to learn to pilot in one-half the time that it otherwise would take.

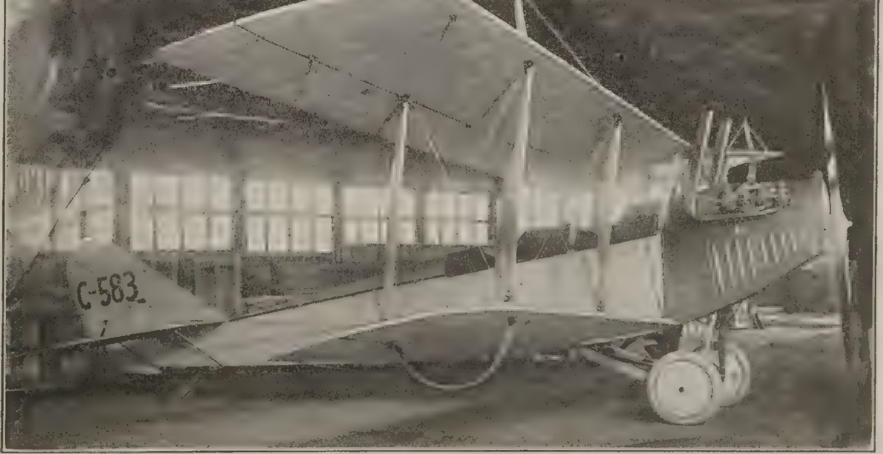
Victor Carlstrom was born on April 12, 1890, in Gustaf Fahn Lan, Sweden, and received his license as an aviator from the Aero Club of America on July 24, 1912, his license number being 144.

Personal Paragraph

L. M. Allison, formerly of the Standard Aero Corporation, has become chief engineer of the Lawson Aircraft Company of Green Bay, Wisconsin.

Fatal Accident to Naval Aviator

Pensacola, Fla.—Ensign D. R. Vankirk, U. S. N., fell 1,000 feet in an aeroplane into Pensacola Bay last week and was drowned in the wreckage of the machine.



The latest Curtiss Model JN-4 military biplane. The new arrangement of the engine exhaust pipes is noteworthy

RAPID WORK IN AERONAUTIC STANDARDIZATION

F. S. DUESENBERG read the report of the Aeronautic Division. In the discussion it was brought out that the Stick control is largely favored for light machines and the Deperdussin control, commonly known as the Dep, is favored for heavier machines. It was also mentioned that standard sizes of engine bed timbers of 12, 14 and 16 in. would also be desirable.

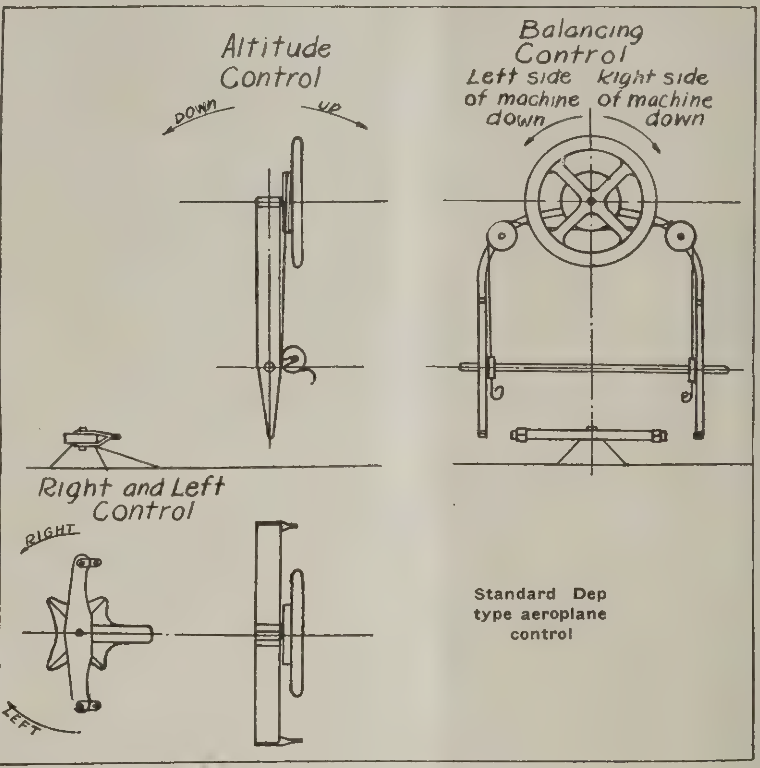
Probably one of the most important steps in view of the formative condition of the aeronautic industry was the decision to adopt the English or inch system of measurement because of the requirements of the United States Army and Navy service.

A letter was read from R. S. Griffin, engineer in chief of the United States Navy Bureau in Washington, in which he stated that the following suggested standards taken from the report are acceptable to the navy department:

1—English system of measurement.
2—Marking oil and fuel lines.
3—Elimination of gage numbers.
4—Engine supports.
5—Spark plugs.

He also suggested that a rubber tube be used to connect the gasoline tank to the carbureter and the Bureau has asked for specimens of the wire and turnbuckle fittings described in the report. In other words, the bureau is still questioning the wire tensile strengths, thimbles, turnbuckles and tachometer shaft drive.

Controls—It is found that these two types of control, namely, the Deperdussin (Dep) and Stick controls are necessary to cover most types of plane in military use. The standards specify that particular movements produce particular effects, but do not specify the connections, since these vary a great deal in practice.



Standard Dep type aeroplane control

Details for Planes

Hard Wire Loop—This consists of an oval coil of wire through which the hard wire is slipped, bent in the form of a loop, again inserted, and the end bent over against the coil. The whole is then soldered. This is identical with the present British standard.

Flexible Cable Ends—The sketch shows the cable end wrapped around a "standard thimble." The length of splice from pointed end of opening in thimble was represented by "splice plus or minus ⅛ in." The end of the splice is wrapped with a serving of shellacked harness thread. Dimension *A* represents the distance from end of opening in thimble to end of serving.

Diameter of Cable	Length of Splice	Number of Tucks	Length of Serving	A	Full Strength of Cable
3/32 7 x 14	1¼		1	½	800
⅛ 7 x 19	1½	3 over	1	½	2000
5/32 7 x 19	1¾	core buried	1¼	½	2800
3/16 7 x 19	1⅞	4 under	1¼	¾	4200
7/32 7 x 19	2⅝		1¼	¾	5600

Galvanized Non-Flexible Ends—The cable end is wrapped about a thimble, with a total length of splice indicated by *L;* 0.041 in. soft steel wire is to be used for wrapping, and the sketch indicates two spaces left between convolutions of the wrapping wire, width of the spaces being indicated in the table. The accompanying table gives the sizes and strengths:

Diameter of Cable	L	Space	Wind	Full Strength of Cable
1/16 1 x 19	1½	⅛	1	500
3/32 1 x 19	2	⅛	1¼	1100
⅛ 1 x 19	2½	⅛	1½	2100
5/32 1 x 19	2¾	⅛	2	3200
3/16 1 x 19	3	3/16	2¼	4600
7/32 1 x 19	3½	3/16	2¼	6100
¼ 1 x 19	4	¼	2½	8000

Thimbles—It was voted to approve, subject to approval by the departments of War or Navy, thimbles for wire ends as shown by Plate No. 7 following page 118, First Annual Report of the National Advisory Committee for Aeronautics (1915). These thimbles will be shown by appropriate drawings. The sizes are indicated roughly by the following table:

Size of Rope	Thickness of Thimble	Width of Eye	Length of Eye
1/16-3/32	0.075	0.35	0.70
⅛	0.12	0.35	0.70
5/32	0.17	0.40	0.80
3/16	0.21	0.50	1.00
7/32	0.24	0.60	1.20
¼	0.27	0.70	1.40
9/32	0.30	0.80	1.60
5/16	0.33	0.90	1.80
⅜	0.39	1.00	2.00

Turnbuckles—Detail dimensions of both short and long types are being studied by a subdivision consisting of Chairman Manly and Capt. Clark. The following main dimensions are recommended for immediate adoption:
(With either two eye ends or one eye and one yoke end.)

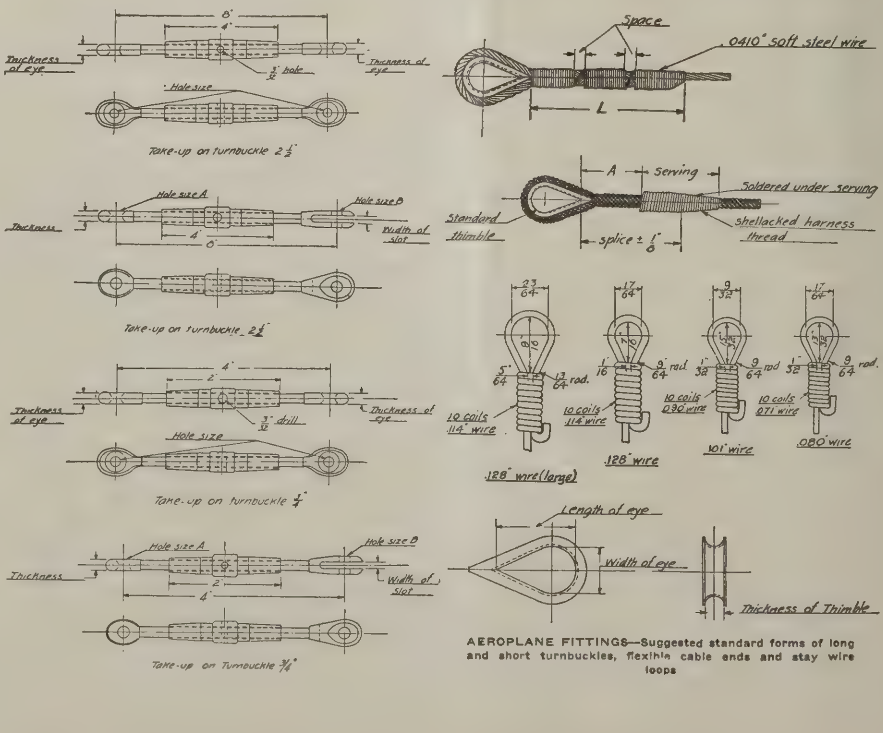
	Short	Long
Length of Barrel	2	4
Length between eyes:		
With threads flush with ends of barrel	4	8
With maximum extended	4-3/16	8-3/16
With minimum extended	3¼	5½

Strength (Lbs.)

S. A. E. Numbers	Short	Long
1	500	500
2	1000	1000
3	1500	1500
4	2000	2000
5	2500	2500
6	3000	3000
7	3500	3500
8	....	4000
9	....	4500
10	....	5000
11	....	6000
12	....	7000
13	....	8000
14	....	9000
15	....	10,000

Marking Pipe Lines—Gasoline lines should be marked with red stripes ½ in. wide painted around the pipes 24 in. apart, care being observed that there is a stripe near each end of the pipe.

The oil lines to be marked similarly but with white stripes.



AEROPLANE FITTINGS—Suggested standard forms of long and short turnbuckles, flexible cable ends and stay wire loops

Elimination of Gage Numbers—Sheet metal is to be specified by thickness in decimal fractions of an inch. Rods, wires and cables are to be specified by diameter in decimal fractions of an inch. Tubes are to be specified by outside diameter in inches or fractions and thickness of wall in decimal fractions of an inch.

Engine Supports—The division recommends the following table of dimensions, omitting all reference to sizes of bolts:

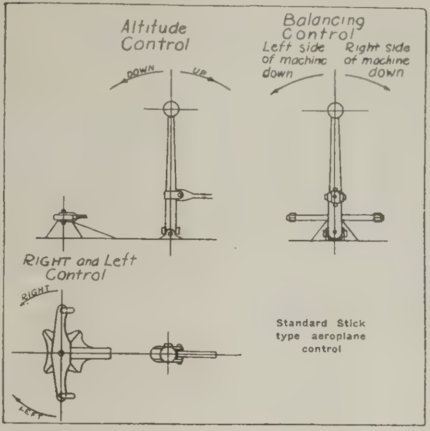
Distance between timbers...	12	14	16
Width of bed timbers......	2	2¼	2½
Distance between centers of bolts	14	16¼	18½

Basic System of Measurements—In view of the fact that the Army and Navy Departments are not both in favor of adopting the metric system, and further in view of the necessity of arriving at standards that will mean the least possibly delay in the production of aeroplane parts, this division recommends definitely to use the English system of measurement except in isolated cases such as spark-plug threads where the metric system is desirable in order to effect interchangeability with some well established standard.

Spark Plug Dimensions—The following dimensions for spark plugs were agreed upon:

Thread: 18 mm., 1½ mm. pitch.

Form of thread: International standard (Same as U. S. standard only with one-half as much truncation at root of thread).



Standard Stick type aeroplane control

Gasket shoulder to end of shell: ⅝ in.

Hexagon: 1 in. across flats.

The question of thread tolerances was deferred.

Propeller Hubs—The design of propeller hubs of various sizes should be based upon pounds-feet torque and not on horsepower.

Direction of Engine Rotation—The direction of engine rotation is normal when the final power delivery member of the engine rotates anti-clockwise, viewed facing the power delivery end. Opposite rotation is anti-normal.

Approval of Existing S. A. E. Standards—The following list of existing S. A. E. standards was approved for aeronautic practice:

Screws and Bolts: (A committee has been appointed to recommend supplemental standards.) Heat treatments; test specimens; ball bearing sizes; throttle levers; magneto dimensions, and cotter pin sizes.

Aeronautic Work Still in Progress

A sub-division consisting of Messers. Vincent, Crane and King has been appointed to take up the subject of pipe fittings. Data are also being collected regarding high grade alloy steel tubing. Some revision of the propeller shaft end dimensions is under consideration. Prof. Z. Jefferies, Aluminum Castings Co., and K. W. Zimmerschied, chairman of the iron and steel division, have been requested to submit suggestions in regard to aluminum alloy specifications.

Referred Back to Division

Three recommendations contained in the report were referred back to the division. The first of these suggested certain standard sizes for tires and rims; the second was a suggested standard design for a tachometer driveshaft, and the third was an acceptance for aeronautic work of the existing iron and steel standard specifications.

(*Continued on page* 334)

REQUIREMENTS FOR SERVICE IN ENLISTED RESERVE CORPS, AVIATION SECTION

(*Continued from page* 295)

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Qualifications; general requirements...... 14
Numbers in each grade.................. 15
Qualifications for direct enlistment into each grade 16
  Master signal electricians........ 16(a)
  Sergeants, first class............ 16(b)
  Sergeants and corporals......... 16(c)
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  Privates .... 16(e)
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Certificates of enlistment............... 18
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Retirement 20
Uniform 21
Term of enlistment..................... 22

14. Qualifications—general requirements.—Service in the Enlisted Reserve Corps, aviation section, Signal Corps, is by enlistment. Applicants must be over 18 and under 45 years of age. They must be of good antecedents and habits and free from bodily defects and diseases. They must be citizens of the United States or have made legal declaration of their intention to become citizens of the United States and be able to speak, read, and write the English language. Before enlisting they are required to pass physical examination to determine their fitness for service in the United States Army. Before authority for enlistment is granted, applicants will furnish two or more certificates of good moral character. As the service is technical, men qualified as aviators, balloonists, or mechanicians, who have had experience in the construction and repair of aeroplanes or internal-combustion engines are particularly desirable.

15. Numbers in each grade.—Following are the numbers authorized in each grade:

(1) 40 master signal electricians.
(2) 140 sergeants, first class.
(3) 200 sergeants.
(4) 400 corporals.
(5) 305 privates, first class.
(6) 915 privates.

2,000 total.

16. Qualifications for direct enlistment into each grade.—Qualifications for enlistment direct into each of these grades are as follows:

(a) *Master signal electricians.*—The candidate must have a practical knowledge of gasoline motors, magnetos, carburetors, telegraphy, and a fair knowledge of the principles of electricity and photography or aeroplanes and balloons.

(b) *Sergeants, first class.*—The candidate must have a working knowledge of gasoline motors, magnetos, carburetors, and a fair knowledge of the principles of metal working.

(c) *Sergeants and corporals.*—Candidates must have a general knowledge of the subjects given under requirements for first-class sergeants.

(d) *Privates, first class.*—Applicants must show an interest in the subjects mentioned, be competent, keen, and of a sufficiently high order of intelligence to insure that they will develop along the proper lines in training.

SECTION IV.

(e) *Privates.*—Applicants must possess the physical, mental, and moral qualifications necessary for enlistment in the Regular Army.

17. Examination, master signal electricians and sergeants, first class.—Candidates for enlistment as master signal electricians and sergeants first class, may be given a written examination embodying the subjects mentioned above.

18. Certificates of enlistment.—When men enlist in any of the above grades, certificates of enlistment in the aviation section, Signal Enlisted Reserve Corps will be issued by The Adjutant General of the Army. When called into active service or when called for purposes of instruction and training, the holders of certificates of enlistment will possess all the authority, rights, and privileges of like grades of the Regular Army during the period of such active service, instruction, or training. Members of the aviation section, Signal Enlisted Reserve Corps, shall take precedence in each grade of said corps according to dates of their certificates of enlistment therein. When called into active service, or for purposes of instruction and training, they shall take precedence next below all other enlisted men of like grades in the Regular Army. The President is authorized by law to assign members of the aviation section, Signal Enlisted Reserve Corps, as reserves to particular organizations of the Regular Army. The Secretary of War is authorized by law to order enlisted men of the aviation section, Signal Enlisted Reserve Corps, to active service for purposes of instruction or training for periods not to exceed 15 days per year, provided that, with the consent of such enlisted men and within the limits of funds available for these purposes, the periods of active service may be extended for such number of enlisted men as may be deemed necessary. During such periods of active service, instruction, or training, and including the time required for actual travel from their homes to the places to which ordered and for return to their homes, enlisted men will receive the pay and allowances of corresponding grades in the Regular Army.

19. Rates of pay.—The grades and pay of the enlisted force of the aviation section, Signal Corps, United States Army, are as follows:

	While serving in the United States, Hawaii, Porto Rico, or the Canal Zone. *Per mo.*	While serving in Alaska, China, or the Philippines. *Per mo.*
Master signal electricians.....	$75.00	$90.00
Sergeants, first-class	45.00	54.00
Sergeants	36.00	43.20
Cooks	30.00	36.00
Corporals	24.00	28.80
Privates, first-class...........	18.00	21.60
Privates	15.00	18.00

All enlisted men of the aviation section, Signal Corps, of the United States Army, in addition to their regular pay, receive rations, quarters, clothing, fuel, bedding, medicine, and medical attendance when required.

20. Retirement.—Enlisted men of the aviation section, Signal Enlisted Reserve Corps, will not be entitled to retirement or to retired pay, nor will they be entitled to pension except in case of physical disability incurred while on active service or while traveling under orders of competent authority to or from designated places of duty.

21. Uniform.—The uniform to be worn by the enlisted men of the aviation section, Signal Enlisted Reserve Corps, except corps insignia, shall be the same as prescribed for enlisted men of the aviation section, Signal Corps of the Regular Army Reserve. In time of peace there shall be issued to each enlisted man of the aviation section, Signal Enlisted Reserve Corps, such articles of clothing and equipment as may be prescribed. All clothing and equipment shall remain the property of the United States.

22. Term of enlistment.—The term of enlistment is four years.

SECTION V.
CIVILIAN AERONAUTICAL SCHOOLS.

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  Pay for tuition.................... 23 (b)
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  Preliminary flying test............ 24 (e)
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Balloon schools, special requirements.... 25
  Pay for tuition.................... 25 (a)
  Character of instruction........... 25 (b)

23. General requirements:—

(a) *Inspection and approval by War Department.*—The civilian aeronautical schools will be those approved by the War Department as to instructors, equipment, and character of instruction to be given. They will be inspected to determine whether these requirements are fulfilled. Before assignment to a civilian school students will be subjected to an examination.

(b) *Pay for tuition.*—Each aviation school will be given a certain compensation for instruction of such personnel assigned thereto in amount to be determined upon by the War Department and the proprietor of the school for each aviation student who qualifies for the preliminary flying test. This amount will be paid when the student satisfactorily completes the course. For each aviation student who graduates from a civilian school as a reserve military aviator an additional sum, jointly to be decided upon by the War Department and the proprietor will be paid to the school. Upon qualification in the preliminary flying test a student may, at the option of the War Department, be transferred to a Government school for advanced training or be permitted to complete his training at the civilian school.

24. Aviation schools—Special requirements.

(a) *Field.*—The field should be of sufficient size and shape to permit of landing and getting away in at least two different directions under normal conditions. The ground must be fairly level and free from obstructions of all kinds. These requisites will be determined on inspection by an officer or agent of the aviation section of the Signal Corps.

(b) *Training machines.*—The training machines will comply with the specifications prescribed by the aviation section, Signal Corps, for the preliminary and advanced training types. These specifications will be furnished all civilian schools who instruct students for the Government, or desire to do so.

(*Continued on page* 338)

METHOD OF SELECTION OF AN AEROPLANE WING AS TO AREA AND SECTION

By J. A. Roché, M. E.

This phase of design, although of great importance if the highest efficiency is to be attained, has long been neglected. The first reason for this was the lack of experimental data on which comparative calculations could be based, and now that this data is plentiful and trustworthy, there is no quick and easy way to lead one to the correct combination of section and area to be used.

This difficulty arises from the fact that both section and area are functions of each other and also of the weight, power, head resistance and intended purpose of the machine.

Anyway, an aeroplane is pretty sure to fly satisfactorily providing that the relation between the above factors be chosen with "good taste" or with an eye on the neighbor's machine, but there is ever the doubt that the machine is not at its best—perhaps a different curve would be preferable—perhaps a little less surface would be better.

One of the common methods now used in making this selection consists in picking out the curve of highest lift to drift ratio available, and finding the area by means of the familiar formula:

$$S = \frac{W}{K_y V^2}$$

Where: W = the weight of the machine, fully loaded.
K_y = the highest lift coefficient
V = the low speed hoped for in m.p.hr.
S = the area sought.

It is generally assumed that the section chosen is the best; because it has the highest lift to drift ratio; but no fair test of the combination is had until the characteristic curves for the aeroplane are drawn. Moreover, to draw such curves for several combinations of section and area would require a great deal of work and then the comparison would be rather difficult.

Now I propose to demonstrate a method which I have found simple and satisfactory.

In general, the problem presents itself as follows:

Specifications require a certain climb, speed range, and useful load to be carried and we are given a power plant. There are seven variables to be considered, namely:

$$K_x, K_y, A, V, S, P, W.$$

These are related by simple expressions:

$$W = K_y S\, V^2$$

$$P = (K_x S\, V^2 + K\, A\, V^2)\, V.$$

Where K_x = The drift coefficient
A = The area of an imaginary square plate whose air resistance would be equal to that of all the structural parts of the machine, or to the parasite resistance.
K = The coefficient for $A = .00328 \dfrac{\text{lbs.}}{\text{sq.}' \times \text{M.P.H.}^2}$
P = The power available in lb. miles per hr.
V, S, W, K_y as above

From which we get by transposition and cancellation:

$$K_y = \frac{W}{S\, V^2} \text{ and } K_x = \frac{P}{S\, V^3} - \frac{K\, A}{S}$$

It now becomes necessary to apply to these equations the factors that will make them yield results in terms of the desired units and those that will compensate for the following: Aspect ratio, reduction of size and wind velocity, interference or biplane effect.

All possible care must be exercised in selecting these coefficients, they will be different for different types of machines—the following are not chosen with any type in view. Some valuable indications of these coefficients may be found in Loening's "Military Aeroplanes" and in Eiffel's books.

Mr. Eiffel recommends that the area be multiplied by 1.1 to allow for the greater efficiency of large planes moving at high speed. We can also multiply the area by 1.08 to allow for the greater efficiency of the aspect ratios commonly used. Finally K_y, being affected by interference, can be multiplied by .9, the equations thus corrected become:

$$K_y = \frac{W}{1.08 \times 1.1 \times 9 \times SV^2} = \frac{W}{1.07\, SV^2}$$

$$K_x = \frac{P}{1.1 \times 1.08 \times SV^3} - \frac{KA}{1.1 \times 1.08 \times S} = \frac{P}{1.19\, SV^3} - \frac{KA}{1.19\, S}$$

It would be more accurate to apply these corrections to the characteristic curves of the wing sections tested, however the errors of this method are slight, and since the same error is introduced in all cases, the value of this method is not impaired for purposes of comparison.

Consider the graph of these equations, K_x being plotted against K_y for various values of V and for assumed constant values of S, W, P and A.

Note that these equations give the values of K_y *necessary* to fly and the values of K_x *available* at various velocities. Note also that the effect of the second term of the K_x equation is merely to subtract a constant amount from the K_x which would be available were there no head resistance. This amount depends only on A and S and its value is read on the K_x scale of the diagram. The effect of this term is then to displace the origin of the plot to the right along the K_x axis. In order that this origin be easily located for any possible value of A, which will naturally vary according to the dimensions of the machine, and for the values of S under consideration, a set of lines is drawn as shown on lower left hand corner of wing selection diagram, from which the value of $\dfrac{K\,A}{1.19\, S}$ is projected up on the K_x scale and the origin thus located for any given conditions. Using this new origin K_y values remain as they were, but the new K_x values are those that remain to drive the wings alone through the air.

Now consider the polar curves of certain tested wing sections; these curves first devised by Mr. Eiffel seem to me by far the most ingenious method of representing the characteristics of a wing section, and I wonder why their use has not been more widely adopted in this country. Polar curves can be derived, however, from any other characteristic curves available, or translated to the desired scale of units and size from foreign polar curves.

Note that these curves give the K_x *required* by the section to move through the air at various angles and the K_y *available* with the section if it is made to travel at various incidences.

Then recalling the matter on page 4
K_x available — K_x required = K_x excess
K_y available — K_y required = K_y excess
K_x excess × AV^2 = Excess power
K_y excess × AV^2 = Excess lifting capacity, extra load which could have been carried,

or

$$\frac{K_x \text{ excess} \times 100}{K_x \text{ available}} = \% \text{ excess power}$$

$$\frac{K_y \text{ excess} \times 100}{K_y \text{ available}} = \% \text{ excess lifting capacity.}$$

These values as well as the speed ranges, can be obtained easily for several combinations of section and area by superposing polar curves and the diagram, several examples of which are given later.

It is evident that the above excesses are the horizontal and vertical intercepts between the selection curve and the polar curve and when these excesses are zero we have the limits of flight range.

We can at once proceed to illustrate the method by an example:

Let W = weight of machine complete with load—2,500 lbs.
H.P. = 120, available with variable efficiency.

Assuming various values for V we can tabulate values for K_y and K_x for values of S. Let us try 250, 350 and 450 sq. ft. Then plot the curves of K_x in function of K_y writing on the curves the velocities for which these coefficients occur. This will be our wing selection diagram.

A curve in the example is also given for 350 sq. ft. and 1,900 lbs. to stimulate empty gas tanks, in order to show the conditions of flight when the machine is light.

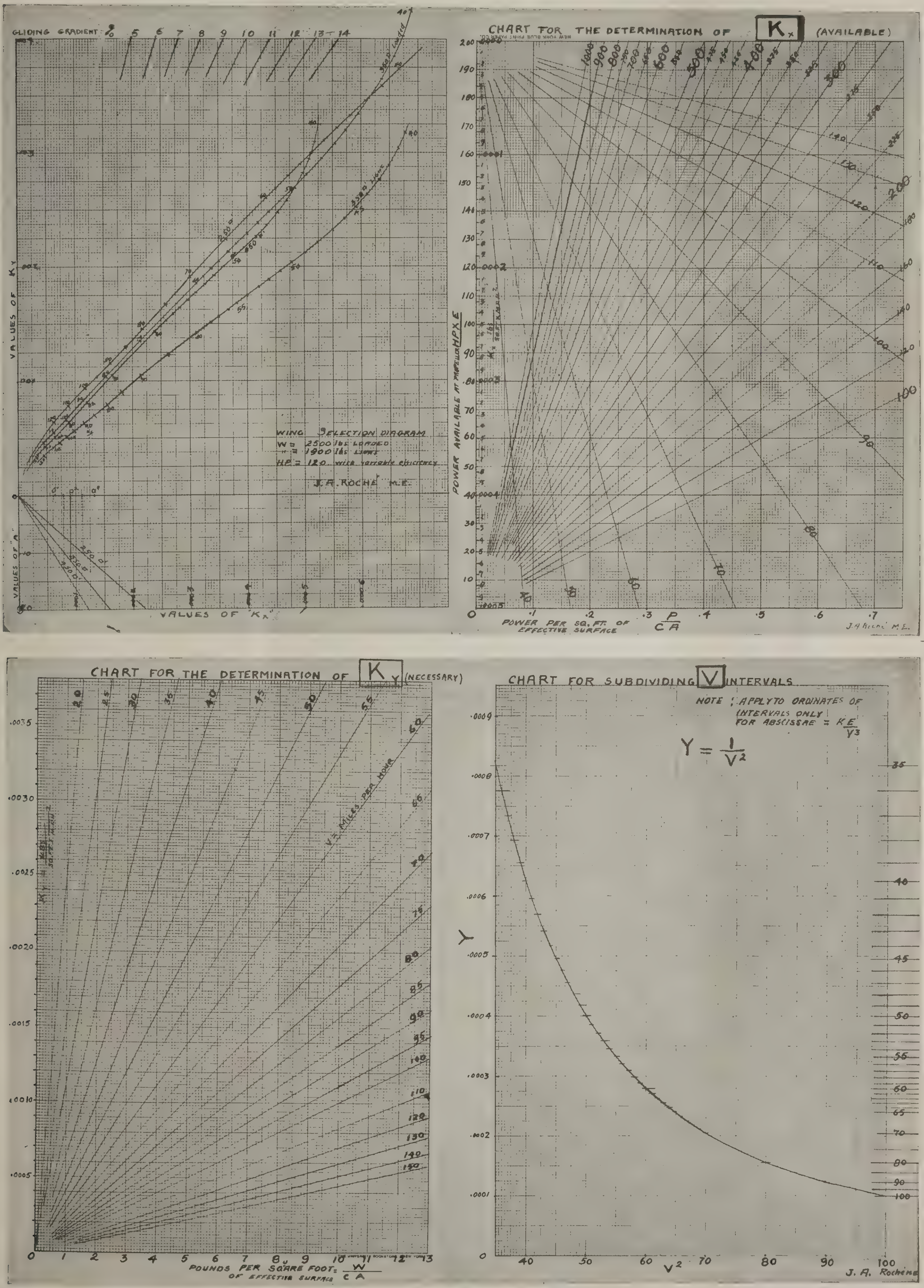
The peculiar waves in these curves are due to the variable efficiency assumed for the power plant. We know that this varies from zero when the machine is standing still to a maximum value when the machine is going near its highest speed, and then decreases again. If the efficiency was constant these curves would be of the simple form:

$$X = CY^{1\,1/2} + c \text{ which is a parabola}$$

The tabulation and diagram follow:

E = Assumed efficiency of power plant
$HP \times E$ = Power available

(To be continued)



Wing selection diagram calculation charts used to facilitate computation of coefficients and calibration scale used to graduate diagram.

THE MECHANICAL DEVELOPMENT OF AVIATION

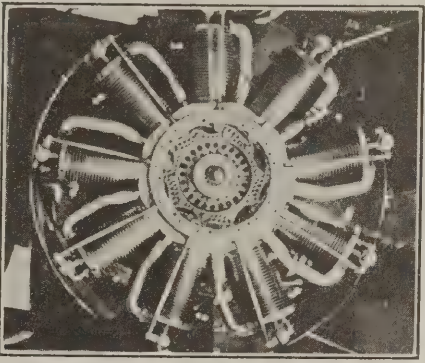
By NEIL MacCOULL, M. E.*

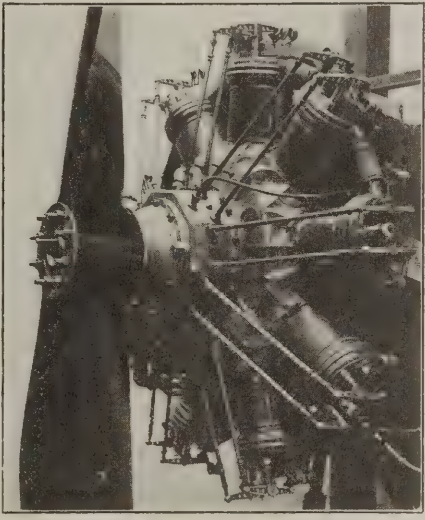
(Continued from page 261)

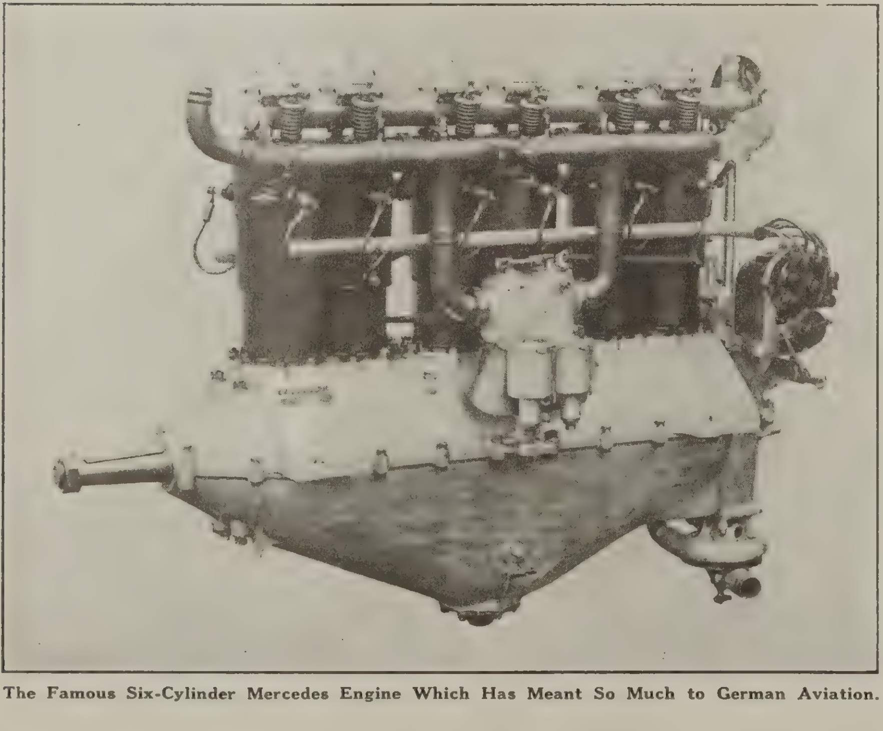
All this work of Langley's was terminated in 1903. Four years later Bleriot constructed an aeroplane of the Langley type, and was able to make short flights of a few hundred yards. The evolution of this machine resulted in the well known "Bleriot type" which is now famous in having been the first to cross the English Channel. In looking over some of my clippings a few days ago I found one from the New York Herald dated Sept 9, 1908, with large double column headlines which read: "Orville Wright Flies for 11 minutes." It brought home very vividly the extreme youth of this new science.

It is during this early period of development that the genius of inventors who were unguided by engineering knowledge went wild, and Fig. 8 is an example of the type of creation they turned out. It was described in an automobile publication in the early days, under the caption of "Why Few Airships Fly." An excerpt from the article is very interesting. It reads thus: "When every element that tends toward safety and reliability in an engine is sacrificed for light weight, the result is not apt to be sound mechanically nor in any other sense of the word. But this is in effect what the average designer of an engine for aerial navigation does, particularly when he happens to be an individual to whom the attainment of aerial navigation is everything and the engine merely an incident. But for all that, he is not content to take advantage of the principles evolved by gasoline engine designers after many years' study and practice, and must needs bring forth a genesis of internal combustion engine from the depths of his own inner consciousness. This is a four cylinder horizontal opposed, two cycle air cooled engine, without a crank-case. Initial compression is obtained by closing the inner ends of the cylinders by rectangular aluminum casings which move back and forth with the pistons. To insure sufficient cooling surface the smooth cylinders are tightly wound with a mass of woven wire, which gives them much the appearance of being sections of a mattress out of place."

Since then progress has been very rapid. Five years elapsed from the time Langley solved the aerodynamic and mechanical details necessary for flight, before the Wright brothers succeeded in flying before the public for eleven minutes; and in 1914, only six years later, the world's record for a non-stop flight had been raised to 24 hours, and a distance of 1,500 miles. This record still stands officially, for what is done in warfare is not accurately known by the public. This is the reason that Prèvost's speed record of 126 miles an hour made in 1913 still stands as official.


The Revolving Air-cooled La Rhone Engine.


Nine-Cylinder Salmson Radial Engine.


The Famous Six-Cylinder Mercedes Engine Which Has Meant So Much to German Aviation.

But in spite of the fact that records for distance and speed have not been broken officially during the last three years, development has by no means retarded. Quite the contrary. We have been passing into that period where the aeroplane has been going through the refinements necessary for it to become an indispensable utility for the existence of nations, when they are beset by the calamities of war. It is really the beginning of the commercialization of the aeroplane. An engineer with whom I am acquainted has just returned from Europe with the most amazing accounts of the magnitude of foreign aeronautical progress. He states that there are in France to-day 70,000 men wearing the uniform of the British Flying Corps, including pilots, mechanics and other helpers. France and England together have about 14,000 licensed aviators, and Germany and Austria undoubtedly have as many. These 28,000 aviators do not include those of Russia and Italy. But even more astonishing than this is the statement made recently before the British House of Commons, that during the past two years Britain has spent $200,000,000 in aircraft. Another American engineer returning from Europe a year ago, after observing aeronautical conditions at the front for one of our automobile manufacturers interested in aviation, reported the sensations he experienced while flying several hundred miles in one of the Royal Flying Corps' giant triplanes, which had a wing spread of 135 feet, weighed just under 30,000 pounds, and was propelled by a total of more than 1,000 horsepower in four units. The whole world will be dumbfounded at the status of the aeroplane when the veil of the censor is drawn after the war.

One of the first engines to spring into prominence while aeroplane progress was being made by leaps and bounds, was the Gnome. It was an air-cooled revolving type somewhat resembling Mr. Langley's early though unsuccessful engine, and is an example of the most beautiful workmanship of which French mechanics are capable; which is one reason for the fact that even now it holds the world's altitude and speed records. It has two faults which have caused it to fall into disfavor in several branches of military service during the last two years. It has an inherently high fuel consumption, and it requires skilled attention. For powers up to about 100 horsepower, it is so much lighter than the conventional water-cooled engines, weighing less than half as much, that it will always have value in the type of aeroplane service where speed and quick climbing are prime essentials, and long flights are not desired. Such service is found in defending cities and fortifications from enemy aircraft, and it is gratifying to learn that our Army and Navy have at last purchased a good many of them from an American firm which has been manufacturing them for abroad.

The La Rhone, which is shown in Fig. 9, is another engine of similar type, though considerably improved, and is now manufactured by the Gnome Company. The intake and exhaust valves are located in the cylinder heads and are both operated by a single rocker. The rocker for each cylinder is operated by a "pull and push" rod, which in turn is given motion by the large cam shown within the crank-case, the crank-case cover, which is integral with the propeller shaft, having been removed before the photograph was taken. It will be noticed that this cam, which operates all "push and pull" rods for the nine cylinders, has five points. This is because it rotates at 9/10 engine speed and in the same direction as the cylinders. The ingenious valve driving mechanisms of many of these revolving engines make a very interesting study.

The only radial water-cooled engine which has enjoyed any degree of success since Mr. Manly's development of this type, is the Salmson, and during the first part of the war it was highly spoken of in France Fig 10 shows a nine cylinder engine rated at 120 horsepower when making 1,300 r. p. m. The valves, which are in the cylinder heads, are operated by individual cams placed side by side on the same spindle. The unusual valve springs are worthy of notice, since the object of this construction is to keep the springs away from the heat of the cylinders. All connecting rods are identical and pinned at equal distances around a collar which surrounds the crankpin bearing, no master rod being used. In order to prevent the collar from rotating about the crank-pin as a center, its position is determined by a train of three gears of equal diameter: one fixed to the collar; one to the crankcase, concentric with the shaft, and the third fixed to the crankweb, as an idler between the other two. This construction secures equal angularity for each connecting-rod, which is

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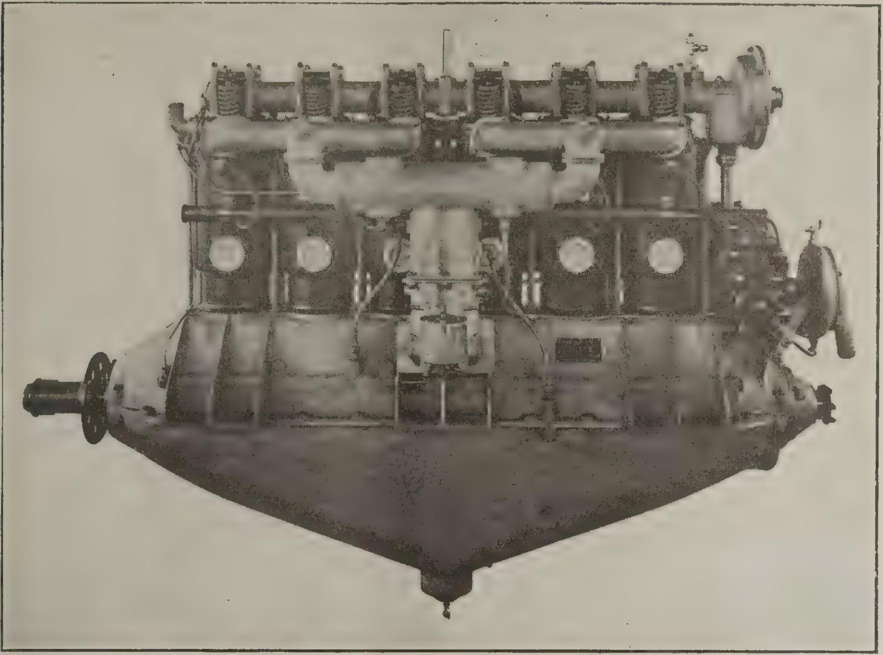
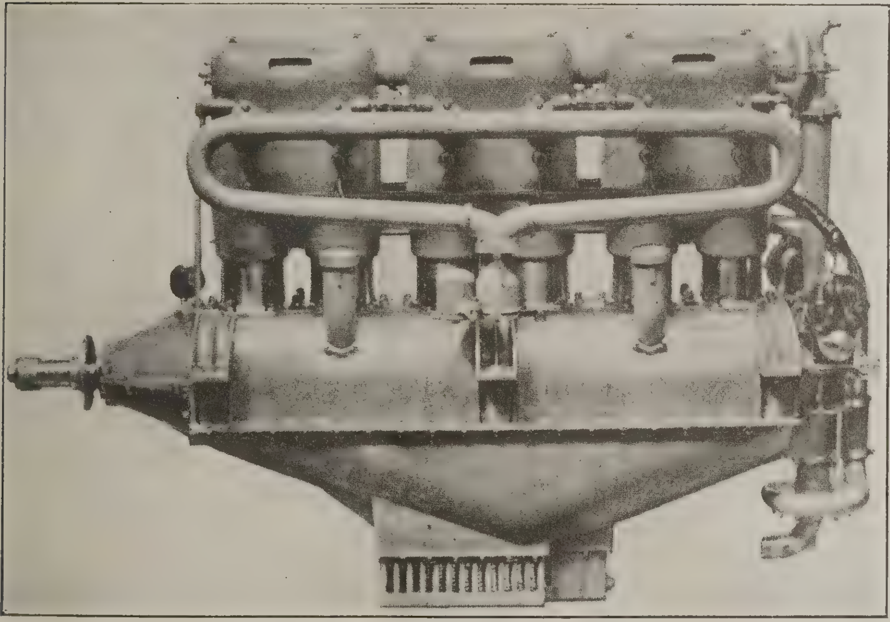
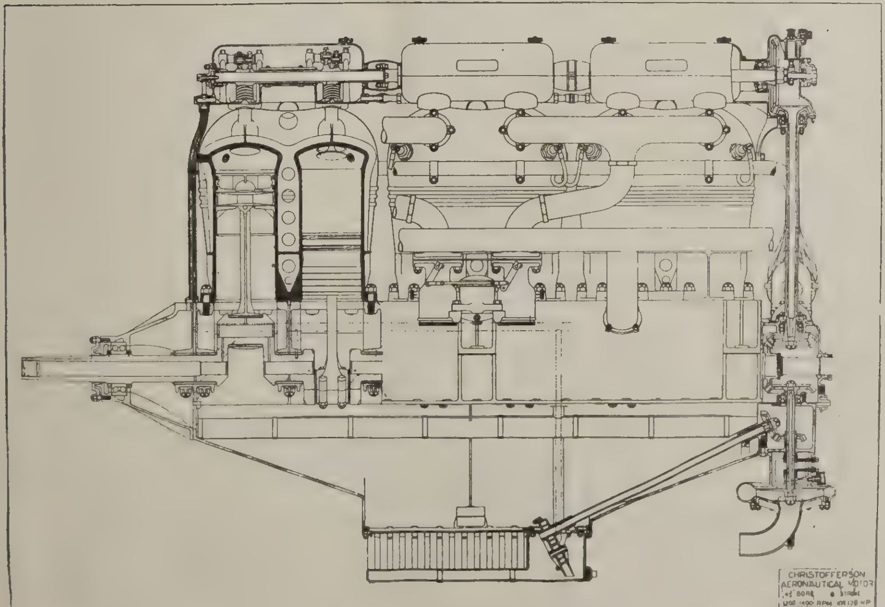
* The Westinghouse Machine Co.



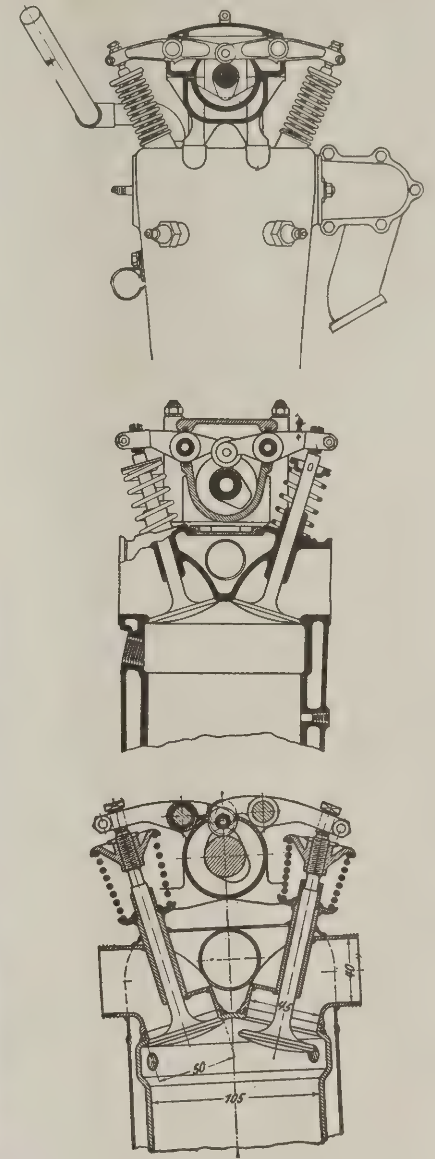
The Hall-Scott, 5 x 7 In. Cylinders, 125 H.P.



The Christofferson Engine, Provided With a Peculiar Intake Manifold, and an Oil Radiator at the Base of the Crank-Case.



Cross-section of the Christofferson Engine.



Valve Mechanism of Three Typical "Overhead Camshaft" Engines. Left: Mercedes; center, Hall-Scott; right, Wisconsin.

not a characteristic of rods pinned to a master rod, as in the case of the Gnome and Manly.

But the great majority of modern aeroplane engines are an outgrowth of conventional automobile practice. One of the most famous engines of this type is the German Mercedes, which has had such phenomenal success that many of the latest engines follow it in general design. Fig. 11 shows the carbureter side of the particular design of this engine which first brought the name of Mercedes among the world's leaders. The most noticeable feature of the design is the method of operating the overhead valves by an overhead cam-shaft. While this general type of valve drive is now the prevailing style, it was quite an innovation when developed on the Mercedes. Notice how generally the engine follows the fundamental principles of accepted automobile practice. In fact, this very engine was used in racing automobiles, and has given their drivers many enviable records. No very great effort has been taken to make this engine especially light except in the cylinder construction. The cylinders, which are in pairs, are built up from steel by welding the individual parts together. The strong point of these engines has always been their reliability rather than absence of weight. It is interesting to read British reports on captured Mercedes engines during the early part of the war, in which much satisfaction is expressed in the fact that nothing unknown to British designers was revealed. Herein lies the secret of the just fame of the Mercedes: its designers instead of looking for radical departures from standard types, in order to save weight, were willing to apply minute attention to the development of recognized engineering principles in every infinitesimal detail.

There are a few characteristics of this engine which it is well to point out here, since they are now found on practically all aeroplane engines. One is a double carbureter for six cylinders. Surprising claims of gains in engine power are made for the use of two carbureters instead of one. Instances of over 20 per cent

(*Continued on page* 334)

KNOX 300 H. P. AIRCRAFT ENGINE PASSES U. S. NAVY TEST

AERIAL AGE is enabled this week to present the official report of the Government tests of the Knox 300 h.p. aircraft engine, which were conducted March 13th, 14th and 15th by the Department of Inspection of Engineering Materials of the United States Navy.

The tests consisted of:

First—Making a run for determining the points of a horsepower vs. revolutions curve.

Second—A run of six hours at rated load and rated speed.

Third—Motor was entirely disassembled, thoroughly inspected, measured up and reassembled.

Fourth—A run of an hour was made after reassembling.

The report states:

"The tests were conducted in the research laboratory of the Knox Motors Company, at Springfield, Mass., which is equipped with a Sprague electric dynamometer for measuring the output of the aircraft engine. It was not possible at the time of installation of this dynamometer to obtain one unit large enough for the purpose, therefore two units are used coupled in tandem, each unit having its arm the same length so that direct scale readings for torque may be made and added together without further computations.

"The gasoline used had a specific gravity of .743, or Baumé .585, and a calorific value of 18,900 b.t.u. per pound and was measured in calibrated tanks.

"The lubricating oil used was Oilzum fed by a gear pump with a capacity of 12 gallons per minute at 70 pounds pressure.

"The cooling water was contained in a large tank into which the entrance of fresh water could be regulated so as to keep the water entering the engine at a predetermined temperature. In the six-hour run 26½ per cent. of the heat units were absorbed by the water. This is about 60 per cent. of the amount generally used in automobile engines and thus allows of a much smaller radiator per horsepower.

"The motor is a twelve-cylinder of 4¾-inch bore by 7-inch stroke, rated at 300 h.p. at 1800 r.p.m., geared down to 1080 r.p.m. of propeller, and fully equipped with electric starting, total weight being 1,430 pounds. Besides the starting and lighting system, it carries a two-cycle air pump for furnishing pressure to the gasoline system and also a stub shaft is brought out for driving the generator of a wireless apparatus.

"The equipment consists of two Zenith 2-inch duplex carbureters, Delco battery type ignition, Rajah metric porcelain spark plugs, Bijur starting motor and generator. The current for ignition is taken from the battery at starting and from the generator when running.

"Forty-seven per cent. of the weight of the engine is a special aluminum alloy. The crankshaft is of chrome nickel steel carefully treated for great toughness. When each end is held on supports, the center may be deflected over two inches without a permanent set. Other parts are made of high grade alloy steels treated in the Knox plant to give the qualities required by the use of the piece. Great pains were taken to so design the engine that all parts were made in one piece as far as possible to eliminate the danger of loosening joints. The timing gears are integral with their shafts. The propeller gears are splined to the shafts with integral splines. Even the propeller shaft has no key in the taper, the hub having integral dogs which mesh with integral jaws on the shaft.

"The motor has a compression ratio of approximately 4.2 to 1, giving a cold compression at 120 r.p.m. of 75 pounds.

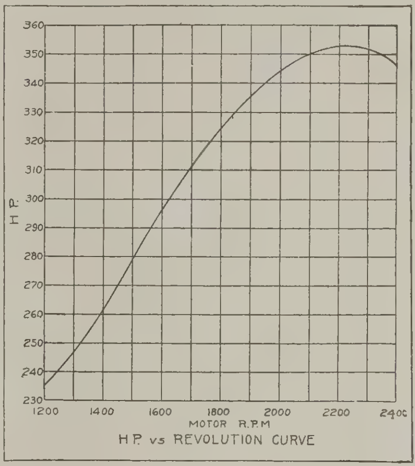
"The first test consisted in making a run with wide open throttle to obtain the points for plotting a revolution vs. horsepower curve. The speed readings were taken at three different points, viz.: the electric tachometer on the dynamometer switchboard, a revolution counter on the propeller shaft, and a second revolution counter on the motor half time shaft. The torque was measured on the dynamometer scale balance beams so that at each point the engine was run about five minutes including the greatest speed (2400 r.p.m.) at which speed the pistons have an average speed of 2800 feet per minute. At the average speed of the test the piston speed was over 2100 feet per minute, yet when the motor was disassembled for inspection after the six-hour run, no wear could be found in the pistons at the wrint pin bearings.

"The readings taken for this revolution vs. horsepower curve were:

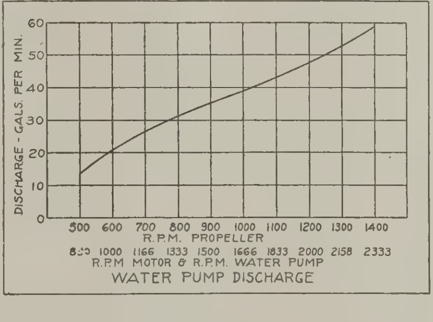
Motor R.P.M.	Propeller R.P.M.	H.P.	Torque Ft. Lbs.
1217	730	235	1685
1350	810	255.5	1655
1605	960	308	1715
1797	1086	322	1565
2039	1224	347	1485
2247	1340	353	1375
2390	1428	346.5	1265

"These readings are plotted in Fig. 1.

"The six-hour run was started at noon and readings of speed, torque, oil pressure and water inlet and outlet temperatures were taken every fifteen minuts. The day of this run the temperature in the laboratory varied from 72 at the start to a maximum of 81 and dropped to 67 near the end of the run. The day was clear, barometer reading 29.9" Hg. The gasoline used had a Baumé reading of .585 and a calorific value of 18,900 b.t.u. per pound. The readings taken during the six-hour run were as follows:



H.P. vs REVOLUTION CURVE



WATER PUMP DISCHARGE

Time H.M.	Motor R.P.M.	H.P.	Oil Pressure	Water Inlet	Temperature Outlet
00	1807	307	75	106	137
15	1820	309.5	70	102	136
30	1824	310	60	104	138
45	1815	309	60	104	138
1:00	1807	307	60	110	146
1:15	1794	305	60	106	140
1:30	1810	307.5	60	106	140
1:45	1831	311.5	60	88	129
2:00	1786	303.5	62	100	135
2:15	1793	305	68	103	137
2:30	1789	304	64	64	124
2:45	1809	307.5	62	91	133
3:00	1795	305	61	98	137
3:15	1840	312.5	60	96	134
3:30	1811	308	61	92	134
3:45	1864	317	62	100	134
4:00	1815	306.5	61	100	134
4:15	1814	308.5	62	102	136
4:30	1829	237	65	100	136
4:45	1810	287	65	100	136
5:00	1890	306.5	61	103	134
5:15	1869	304.5	60	101	135
5:30	1845	307	61	98	134
5:45	1838	304	60	98	134
6:00	1892	315	60	94	134
Average	1835	304.28	62.96	99.52	135.48

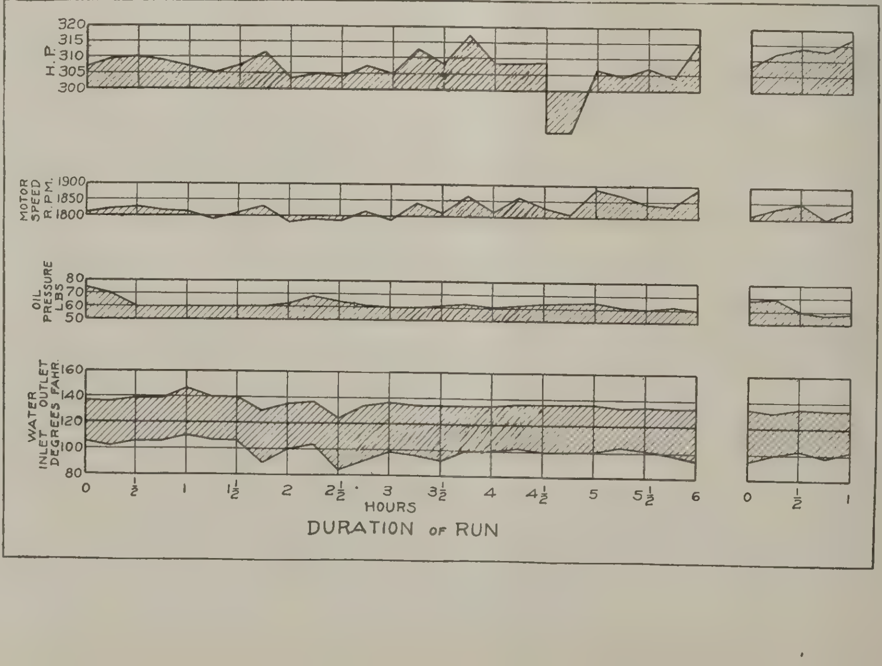
'These readings are plotted in Fig. 2.

"Shortly after four hours and fifteen minutes had elapsed, the valves between the calibrated gasoline tanks and the carbureters were accidentally closed by one of the employes who mistook these for the valves used in filling the calibrated tanks. The case of the stop was immediately located, the engine restarted, and the readings made at four hours and one-half, at which time it was noted that the resistance grids of the dynamometer set had become so hot that their resistance effect was lessened, and there was not enough load to hold 300 horsepower at the rated speed. As horsepower is a combination of speed and torque, when the torque decreases, it is necessary to increase the speed, therfore it was decided to increase the engine speed to bring the horsepower over its rated 300.

"During this six-hour run 22.45 per cent. of the heat units were converted into work, 26.5 per cent. were used in the cooling water and 51.05 per cent. used in radiation, friction, exhaust, etc.

"After this run the engine was disassembled, various parts measured for wear and careful search made for defective parts. One exhaust

(Continued on page 334)



DURATION OF RUN

FOREIGN NEWS

FRANCE

Paris, May 11th.—The Aero Club of France gave a dinner last night in honor of the American aviators at the front. Among the guests were Robert W. Bliss, secretary of the American Embassy; Daniel Vincent, Under Secretary of Aeronautics, and Colonel Regnier, Director of Military Aeronautics. The American Ambassador had been invited but was unable to attend.

Sergeant-Major Raoul Lufbery received from the club a gold medal, which was presented by the president, Mr. Henry Deutsch de la Meurthe, who made a brief address expressing the club's gratitude and admiration for the gallantry of the American aviators.

Paris, May 12.—A German aeroplane flew over the French front yesterday and scattered copies of President Wilson's speech printed in German which *The World* distributed originally through the French army aviators. Evidently copies had been picked up inside the German lines and were dropped within the French lines for a joke.

Hot anti-aircraft gunfire drove the German flyer back to his own lines, and French soldiers eagerly seized the leaflets as souvenirs.

GERMANY

"British and French officer prisoners of all grades began arriving to-day at the new camp established at Freiburg especially designed for officers," says a Berlin telegram of May 12.

The German government recently announced that in reprisal for the placing of a German General and fifteen staff officers on French hospital ships in the Mediterranean, French officers of corresponding rank of thrice this number had been placed "at points in the western industrial districts which are especially subject to aerial attack." Freiburg is a point which has been frequently the object of air raids.

Both the British and the French have placed German prisoners on hospital ships because of the sinking of several such vessels by German submarines.

Fighting in the air has taken on a new interest recently because of the new German policy of painting their machines grotesque patterns. They got this idea from the American Indian custom of painting their faces to frighten their opponents, or else the Spring fancies of the German airmen have been allowed to run riot.

Each day British pilots bring home new reports of fantastic creations encountered amid the clouds. The gayest feathered songsters cannot hope to rival the hues of the Harlequin birds that rise daily from German airdromes.

The coming of this order of things was first heralded by a squadron of scarlet German aeroplanes, met ten or twelve days ago. It was noticed then that some of the German machines were striped about the body like yellow-jackets.

Now there are green aeroplanes with yellow noses, silver ones with gold noses, khaki-colored ones with greenish gray wings, aeroplanes with red bodies, green wings, and yellow stripes, aeroplanes with red body and wings of green on top of blue, aeroplanes with light blue body and red wings. The gaudiest machines go in for red body effects, with every possible combination of colors on their wings. Some have one green wing and one white, while others have green wings tipped with various colors.

One of the most fantastic met had a scarlet body, brown tail, reddish-brown wings, with white Maltese crosses against a bright green background. One machine looked like a pear flying through the air. It had a pear-shaped tail and was painted ruddy brown, like ripe fruit.

GREAT BRITAIN

London, May 8.—The military correspondent of *The Times,* giving further impressions of his recent visit to the British front, replies to criticisms made of the types of aeroplanes used by the British. He says that criticising types is folly, because many different kinds are needed, according to the work on which they are employed, and it is impossible to say which is best.

The writer defends the partial use of second-grade machines as unavoidable, saying that if none but the latest model of each type were used there would be few airmen aloft. He believes that the latest type of the British fiighting plane is equal to the German, but that a greater number of them is needed. This machine is operated by a lone aviator and carries two guns.

In reference to the wear and tear of machines and the strain on the pilots, the correspondent says that the life of an aeroplane does not exceed two months, while the pilots, who are mostly 19 or 20 years old, have to fight for two months before they are much good. The strain is so great that few can stand it for more than three, six, or nine months.

The writer contends that the British have not enough men or enough divisions in the field and says that the severity of the present fighting adds to the gravity of the question.

"Victory or defeat," he concludes, "depends on man power and nothing else stands between us and success."

British Headquarters in France, May 12th, via London.—One of the chief topics of conversation along the whole British front this week has been the disappearance of Captain Albert Ball, the star airman of the British Army. He was last seen near Lens, between half-past six and seven o'clock on May 7. At that time he was engaged with three German machines. He was not seen to fall, however, and no word has been heard thus far from the German aerial corps as to whether he was killed or captured. This is unusual, as the rival air services ordinarily notify each other promptly by messages dropped from aeroplanes of the fate of men who have met with mishaps.

In less than a year Captain Ball had become one of the heroes of the war. Every soldier in the British army knows scores of stories about his prowess and his dexterity in the air. Both he and his friends in the aerial corps had a fatalistic belief that he bore a charmed lfe and could not be killed while flying. Even now the army believes this charm holds and that he is a prisoner, having merely caught an unlucky bullet in some vital part of his machine, forcing him down within the enemy's lines.

Captain Ball had received the Distinguished Service Medal with two bars and also the Military Cross. He lived in Nottingham. When he first entered the army he was wth the Sherwood Foresters. His active service has been with the flying corps, which he joined when he was nineteen years old. He celebrated his twentieth birthday a little while ago.

The missing aviator was of the type of mere boys who make up the flying corps, entire squadrons frequently averaging only twenty-one years of age. He was taken back to England last autumn for a rest after having made a most brilliant record in the Somme fighting, when the British first gained mastery of the air. He came back to France only about a fortnight ago and began a new year of work with even more notable performances than before.

London, May 7.—"In the early hours this morning," says an official announcement to-day, "a hostile aeroplane appeared over the outskirts of Northern London and dropped four bombs. One man was killed and a man and a woman injured. Slight damage was done to buildings."

No one in the area attacked saw anything of the machine. People were awakened by the explosions, but when they reached the street the machine had disappeared. The bomb which caused the casualties fell on the roof of some residences and the other missiles landed in a swamp.

London, May 13.—A considerable raid was carried out on Zeebrugge, the principal German naval base on the Belgian coast, by the British navy and air service early yesterday morning, and although German reports deny that any considerable damage was done, reports from Holland are that two submarine sheds were blown up and nine German aeroplanes shot down.

"A very heavy bombardment of the important area at Zeebrugge was successfully carried out Saturday morning by a portion of our forces under orders of the Dover Vice Admiral," says the British official bulletin.

"The Royal Naval Air Service rendered valuable co-operation, and over fifteen aerial combats occurred, in which four enemy machines were destroyed and five others driven down out of control. Two of our machines failed to return. One of these descended in Dutch territory and was interned."

The German official version of the report is that "enemy monitors, during foggy weather, early Saturday morning, shelled Zeebrugge from a great distance. Our batteries replied. There was no loss of life. Slight material damage was done. Two enemy aeroplanes were shot down."

Despatches from Rotterdam say the raid was the most destructive yet made on Zeebrugge, which has been many times attacked by air and sea in the past two years. Sixty-three were killed and upward of 100 wounded in the destroyed boat sheds.

ITALY

The official report of May 12th, telling of operations the day previous, follows:

"There was lively aerial fighting on both sides. Enemy aircraft last night dropped bombs on Punta Dobba and on some places on the lower Isonzo, causing one casualty. One of our squadrons bombed the railway works at St. Zaniele, in the Branizza Valley, in the Frigidio.

"One of our Caproni machines reached Pola and with bombs caused a fire in the arsenal.

"Enemy aeroplanes repeatedly attempted yesterday to make raids on our territory. They were everywhere driven off by our anti-aircraft guns and airmen. Only one hostile machine succeeded in reaching Brescia and it did not drop any bombs."

JAPAN

The following is from the *Japan Times* of March 24:

The editorial department of the National Aviation Society of Japan has sent a unique tribute to Art Smith, the famous boy aviator, who recently made a series of flights in Japan and is returning to Japan on the Siberia Maru, due in a few days, says a recent issue of a San Francisco paper. The book is entitled "The Aeroplane as a Factor in Bringing Japan and the United States in Closer Friendship," and is made up of press notices telling of his various experiences. He is at the St. Francis Hotel now and has received 200 copies of the book for distribution in this country. Following are excerpts:

"At 8 o'clock, March 18, 1916, Art Smith arrived at Tokyo station. On the platform there stood a general with a long white mustache, who cordially welcomed the famous aviator from America. The general is none other than Lieutenant General Nagaoka. Receiving the warm hand shakes and cordial word from General Nagaoka, Art Smith exclaimed: 'Oh, how could I ever thank you for such kindness.' "

After his first flight in Tokyo, Art Smith has received the following letter together with one yen bill:

"I have seen your flight our house, together with five other members of the family and we were greatly surprised to see you perform such wonderful flights.

"And we thought that to make such flights it may cost you a great amount of money. And when we thought of that we regretted that we saw your flight free from our house. And we are inclosing one yen bill toward your expenses."

The F.B.A.—A French Flying Boat, Equipped with a Hispano-Suiza Motor

THE Curtiss Aeroplane Co. has always been the dominating center of aviation in America. Its capacity has steadily grown until today it is the largest and best equipped aeroplane manufacturing corporation in the world, amply equipped with all facilities for building a large variety of types of aeroplanes, hydroaeroplanes, flying boats and aeronautical motors in *large quantities and for prompt delivery.*

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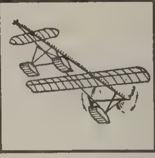
The America Trans Oceanic Co., 280 Madison Avenue, New York City, New York Agents.

Curtiss

MODEL NEWS

Edited by G. A. Cavanagh



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BROADWAY MODEL AERO CLUB
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924 Wabash Ave., Youngstown, Ohio
DENVER MODEL AERO CLUB
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BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

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517 Navarro St., San Antonio, Texas
SPRINGFIELD MODEL AERO CLUB
47 Churchill St., Springfield, Mass.
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

The Formation of Model Clubs

(*Continued from page* 24)

RULES FOR CONTESTS

In our issue of March 19th, we dealt upon the manner in which Model Clubs are formed and the proper course to follow in the election of officers. We now come to the matter of contests. As there are many different types of models so must there be rules to correspond to avoid misunderstandings, and until the club has reached the stage where it may decide upon a particular set of rules under which its members should participate perhaps the following set of rules, applicable to contests for Hand Launched Models, can be adopted. In so far as there are different rules for different contests, namely, R. Hand Launched, R. O. G. and R. O. W. and Mechanical Driven the following rules are used only in connection with contests for Hand Launched Models:

1. A contest to be official must have at least five contestants.
2. Each contestant must abide by the rules of the contest and decision of the judges.
3. Each contestant must register his name, age, and address before the event.
4. Each contestant must enter and fly models made by himself only.
5. Trials to start from a given point indicated by the starter of the trials, and distance to be measured in a straight line from the starting point to where the model first touches the ground, regardless of the curves or circles it may have made.
6. Each contestant must have his models marked with his name and number of his models (1, 2, 3, etc.), and each model will be entitled to three official trials. Contestant has the privilege of changing the planes and propellers as he may see fit, but only three frames can be used in any contest. If in the opinion of the board of judges there are too many entries to give each one nine flights in the length of time fixed, the judges have the power to change that part of rule No. 6 to the following:

    "Six flights will be allowed to each contestant, which can all be made with one model or divided up; due notice must be given to each contestant of the change."
7. No trial is considered as official unless the model flies over 100 feet from the starting point. (The qualifying distance can be changed by agreement between the club and the starter provided the entrants are notified.)
8. Should the rubber become detached from the model, or the propeller drop off during the trial, the trial is counted as official, providing the model has covered the qualifying distance. No matter what may happen to the model after it has covered the qualifying distance the flight is official.
9. Contests should cover a period of three hours, unless otherwise agreed.
10. No contestant shall use the model of another contestant, although the former may have made it himself.
11. The officials should be: a starter, measurer, judge and scorer; also three or four guards to keep starting point and course clear. The first three officials shall, as board of judges, decide all questions and disputes.
12. A space 25 feet square (with stakes and ropes) should be measured off for officials and contestants, together with one assistant for each contestant. All others must be kept out by the guards and a space kept clear (at least 25 feet) in front of the starting point, so a contestant will not be impeded in making his trial.
13. Each official should wear a badge, ribbon or arm band designating his office, and must be upheld in his duties.

(*To be continued*)

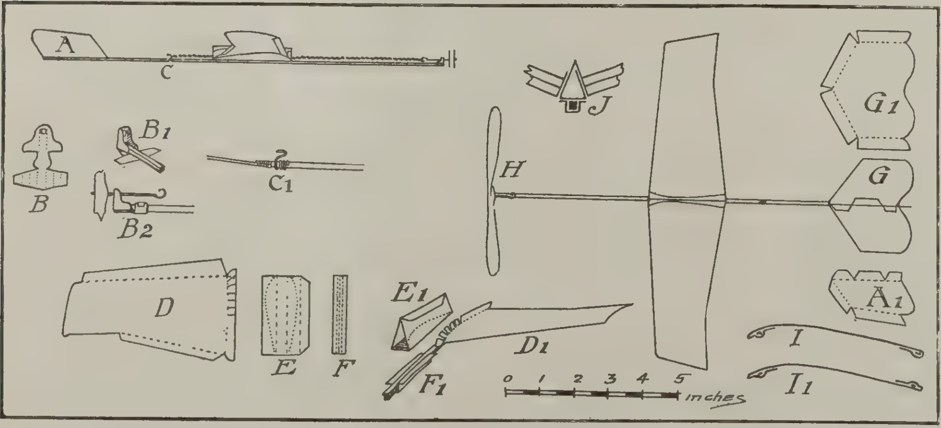
Paper Models

(*Continued from page* 263)

"The wings should be sketched out on paper first, as D, but drawn to full scale. Cut both wings out at the same time, from a double thickness of paper, and fold at the dotted lines. The flaps at leading and trailing edges to be lapped under, and carefully glued down over two very thin cane spars.

"The wing may now be given a curve as in I, which may be produced by rolling the leading half of it round a pencil. Now bend the flaps at the root of the wing upwards, and the result should look similar to D1.

"To construct E, obtain some stouter paper, and cut to shape and dimensions illustrated. Mark out in pencil the wing section, as shown by the fine dotted lines, and fold at the thick dotted lines. This will form a triangular framework, to which the wings may be glued along the pencilled section as D1 to E1. Now cut F from thin paper and glue to backbone as F1, after which the whole may be glued together as J, allowing a free passage for the rubber (which will run above the frame) through the triangular section. The tail construction should, I hope, be self-evident from the diagrams A1 to G1. The flaps in this case are glued down without the insertion of cane spars. The tail, G, is attached to the outrigger in much the same manner as F1, the rudder being glued down by flaps to the top of the same.



"This completes construction, but the beginner should not expect distances in excess of a maximum 150 ft. to be flown by this model. After some experience has been gained, modifications should be carried out, on the lines of the following:

"Lengthen the backbone, so as to allow the use of a greater length of rubber.

"Fit rubber that is normally half an inch longer than the distance between the hooks.

"Glue the rear spar to the top surface of the wing, and lap paper over accordingly, as I 1.

"Endeavor to do without the negative angle of the tail, though at the same time retain the longitudinal stability.

"When trying to obtain a maximum length of flight, lubricate the rubber with soap-jelly (or any other suitable substance).

"The rubber should stand about 500 winds, and should last up from 15 to 20 seconds."

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

A Visit to an Aeroplane Factory

Encouraged by the success of our visit to the Rabid-Radial-Rotary factory a short time ago, we last week decided to pay a visit to the plant of the Hollowspar Aeroplane Company, and see how they were coming along on their machines. Looking up the train schedule, we selected a train—fast freight—and after a trip of eighteen hours, arrived at Wingstrut, L. I., where the famous Hollowspar machines are made. Waiting until the trainman was not looking, we opened the side door, and gently dropped to the ground. Inquiring the way to the Hollowspar factory, and being directed thereto, we decided, for many reasons, to walk to the factory. (The first of our many reasons was that we had no carfare to pay our way, and the rest of the reasons do no count.)

We walked a mile or so, and at last arrived at the factory. Really it was wonderful! We have seen great plants before, among them the gigantic Odor-Engine Plant at Imaginary, New York, but were not prepared for the sight of this magnificent aggregation of buildings which stretched before our astonished view. For miles on all sides the great buildings stretched, while hundreds of workmen stretched (and yawned) all around. One could hear the busy throb of the vast machinery inside, and once in a while could see rays of light issuing from the windows, as one of the workmen got a flash of intelligence.

We stood in front of the buildings for a while, taking notes of the astonishing scenes which confronted our eyes, and then ascended the steps. Arriving at the top of the steps in a little more than a half-hour, we dodged a sledge-hammer which one of the workmen playfully threw at us, and dusting off our clothes, we entered the building.

What a magnificent sight confronted our eyes! We had no idea that an aeroplane factory could afford to employ so many men. We stopped and counted them for a few minutes. In five minutes we counted five thousand men, five thousand women, and about ten thousand other people who were working so fast that we could not tell whether they were men or women. Stopping one of the workmen, by gently tripping him with our foot, we asked to be taken to the president's office.

"The president has no old clothes to sell," he said, and started off.

We called him back, administered a severe lecture to him, and demanded that we be taken to the office of the president. (We later learned the cause for his disrespect. Upon getting into our car, we had unwittingly backed into a freshly painted "Live Stock" sign.) When the workman glanced at our card, we could see a look of extreme awe begin to cover his face.

"I have read some of your stuff," he said.

"Is that a reason for your insulting tone?" we asked.

Without another word he led us directly to the president's office. Pausing at the door, we stopped to read the president's name before going in. Lo and behold! Who was it but Senator J. A. Oszk!

Without saying another word, we dashed through the door and entered just in time to dash off a drink with the Senator. Seating ourselves in front of each other, we started to speak.

"Well, Senator," we said, "it's a long time since we saw each other."

"Marvelous!" he said.

"What is marvelous?" we asked.

"My machine," he responded. "Let me give you a short description of it."

Four hours afterward he stopped to take a breath, and seeing our chance, we interrupted him for sufficient time to write down some notes of what he was telling us. We append a carefully compiled list of the main characteristics of the Senator's new machine.

Name. Hollowspar Speed-Scout.
Stagger. Very pronounced.
High-Speed. 23 M.P.H.
Low Speed. 45,000 R.P.M.
Lubrication. Excellent.
Control. Very easy.
Capacity. Of machine, 354 lbs. Of pilot, 8 seidels an hour.
Motor. Rabid-radial-rotary, or Odor-Engine.
Price. $.65 per square foot. (Cash.)

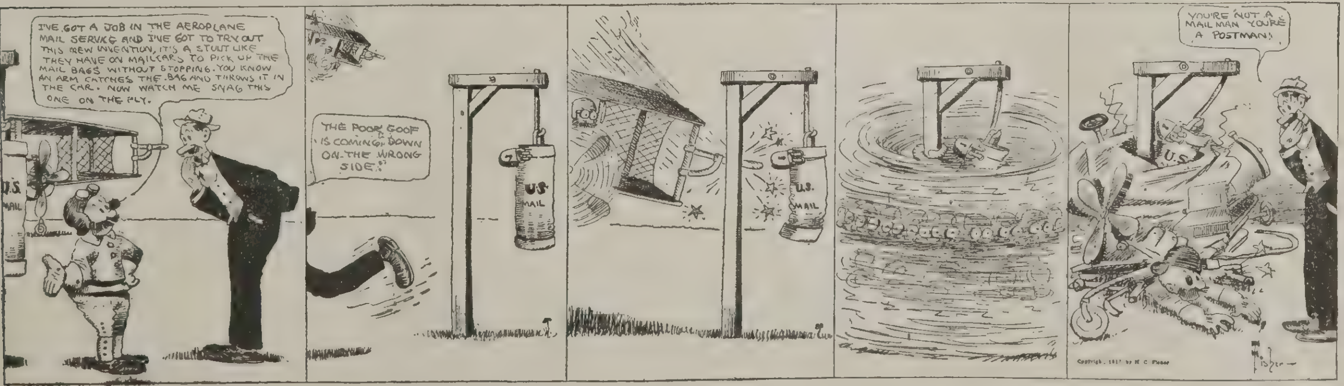
A Few Lines of Advice

Keep the freight cars moving,
Our industry proving;
Turn the green sod upside down
While the planting's good;
Start the hoe and shovel
From each house and hovel;
Make each patch of ground bring forth
Some kind of food;
Keep the transports sailing
And the U-Boats wailing;
Turn the Germans upside down
In the deep blue sea;
Feed our Allied nations
UNCLE SAM'S war rations;
Turn the tide of battle to HUMANITY.

A. P.

Our Own Classified Kolyum

Wanted.—A young man that speaks English and French and understands motors.


I'VE GOT A JOB IN THE AEROPLANE MAIL SERVICE AND I'VE GOT TO TRY OUT THIS NEW INVENTION, IT'S A STUNT LIKE THEY HAVE ON MAILCARS TO PICK UP THE MAIL BAGS WITHOUT STOPPING. YOU KNOW AN ARM CATCHES THE BAG AND THROWS IT IN THE CAR. NOW WATCH ME SNAG THIS ONE ON THE FLY.
U.S. MAIL
THE POOR GOOF IS COMING DOWN ON THE WRONG SIDE!
U.S. MAIL
U.S. MAIL
YOU'RE NOT A MAILMAN YOU'RE A POSTMAN!
U.S.
Fisher

Courtesy N. Y. World.

PERFORMANCE

The New York Aero Construction Company's Twin Motored Seaplane has a maximum speed of 85 miles per hour, excelling the estimate by ten miles per hour. Yet it has a slow landing speed of 43 miles per hour, allowing the landings to be made within a much smaller space than is ordinarily the case. But what is even more important in coast defense work is the fact that it has a

FLYING RADIUS OF NINE HOURS

The advantages of a high speed and a wide flying range are obvious. The coasts of the United States are long, and the swifter the machines that guard them, and the longer they can stay in the air, so much better and more easily are the coasts patrolled. The seaplane mentioned in the editorial of the World could, flying at full speed for its seven hours' flying radius, cover 515 miles. The seaplane of the New York Aero Construction Company could cover 680 miles.

820 Sq. Ft. Supporting Surface. Maximum speed, 85 Miles per hour.
Two 100 H.P. Aeromarine Motors. Minimum speed, 43 Miles per hour.
Weight 2,700 lbs. Useful load 1,700 lbs. Flying radius, nine hours.

Designed and constructed throughout under the supervision of Mr. Warren S. Eaton.

NEW YORK AERO CONSTRUCTION COMPANY, Factory, Newark, New Jersey

(*Continued from page* 323)

J. E. Hale, Goodyear Tire & Rubber Co., inquired regarding the tire sizes which he said are all new. On the other hand, the 26 by 4 has been popular with production running into the thousands and yet these are not mentioned in the report. Duesenberg stated that in the committee meeting no one had made any objections to the tire sizes, although no tire men were present. Hale stated that none of these tires are made but this is a matter which should be considered, and although the situation is by no means grave owing to the relatively small production, it would be a question of making matters much more simpler if existing sizes could be used. Duesenberg pointed out that the 32 by 4½ tire is easily secured and is the normal size for the popular 33 by 5 oversize tire used extensively in racing.

In view of this discussion, Chairman Utz stated that he was willing to receive a motion to the effect that the report be amended so as to exclude the paragraph on tires and rims. This amendment was passed with a suggestion from one of the members that the thickness of the rimstock also be inquired into, because of the difference between that recommended and that now used.

Another matter in connection with the report of the aeronautic division was brought up with regard to the specifications on sheet metals. These were stated to be not full enough, particularly as regards steels, which had to be bent on themselves before heat-treated. Metallurgist Zimmerschied of the General Motors Co. was one of those who concurred in this, and the result was the addition of another amendment excluding that part of the report dealing with the iron and steel specifications, both amendments being carried without any dissent.

Standardizing Tachometer Drive

C. M. Carson, consulting engineer of the H. W. Johns-Manville Co., drew attention to the matter of standardizing tachometer drive, which is under consideration. He stated that where flexible cables of a length up to 16 ft. long are used, the bends in the cable are apt to change the length of the shaft to such an extent that it is doubtful if the keyway suggested is sufficient to hold the engaging members of the driveshaft in place. Berne Nadall of the Stewart-Warner Speedometer Co. concurred in this and others pointed out that the wall is rather thin in the suggested speedometer drive end, whereas in aeronautic work it is necessary to have a rigid fixture at this point. This discussion resulted in the three amendments to the report, which was finally accepted with these three amendments; namely, that the maters of tires, iron and steel specifications, and tachometer drive should be turned back to the division for further review.

(*Continued from page* 328)

valve which showed slight pitting in the seat was the only part replaced. No other valves were reground, no bearings readjusted, and no other parts altered or adjusted in the slightest degree. The bearings, both main and connecting rod, were accurately measured and no wear could be detected. The wrist pins, cylinders and pistons were also carefully measured and no wear could be detected.

"The engine was then reassembled and run for one hour during which the following readings were taken:

Time H.M.	Motor R.P.M.	H.P.	Oil Pressure	Water Inlet	Water Outlet
0	1811	308	68	94	134
15	1835	312	69	99	132
30	1848	314	60	103	135
45	1801	313	57	98	134
1:00	1835	317	58	102	134
Average	1826	312.8	60.4	99.2	134

"These readings are plotted in Fig. 3.

"During the hour of this run the temperature varied from 61 to 74 and the barometer reading was 29.65 Hg. During this run 32 gallons or 199 pounds of fuel was used, making the consumption of fuel equal to .5715 pounds per horsepower hour.

"The oil consumption was .0435 pounds per horsepower hour.

"The brake m.e.p. was 91 pounds per square inch and the thermal efficiency 23.55 per cent.

"The water pump output was determined before the official test and is shown in Fig. 4."

(*Continued from page* 327)

gain are claimed. This seems hardly possible except that practically every successful six cylinder aeroplane engine on the market makes use of two carburetors. Another feature is the use of a double ignition system; two independent magnetos and two sets of independent spark plugs to each cylinder. The deep oil sump with the oil pump at its lowest point is another characteristic. Practically no aeroplane engine is lubricated by splash, high pressure lubrication being used exclusively. One of the chief points in which designers of this type of engine have a chance to show their ingenuity is in the combination of the cam-shaft drive with the drive for the magnetos and pumps. In this engine a bevel gear on the crank-shaft meshes with the bevel gears at the extremities of two vertical shafts, the upper driving the megnotos and cam-shaft thru bevels, and the lower driving the centrifugal water pump seen at the lower extremity to the right, and in addition a horizontal shaft which in turn drives two oil pumps in the lowest part of the crank-case. It is a very neat arrangement.

From the remarkable performance of these engines before the war, it is natural that we should be very inquisitive about the developments which have taken place under the stress of war service. From the latest reports it seems that but few changes have been made. The cylinders are increased in diameter from 4¾ to 5½ inches, so that the engine develops a maximum of 165 horsepower instead of 100. The cylinders are now individual instead of in pairs, but retain their welded steel water jackets. The drive of the cam-shaft and auxiliaries has been modified, so that the water pump is just below the cam-shaft bevels, the rotor being mounted on the vertical driveshaft which passes through it. This gives room for the oil pump where the water pump was formerly, and simplifies the drive of the former. All these changes are merely design refinements which considerably reduce the cost of manufacture and make the parts more accessible. The only departures from former designs in principle are the addition of cooling ribs on the bottom of the oil sump, and a set of decompression cams which are thrown into action by sliding the cam-shaft horizontally, and makes starting the engine by hand a fairly easy task. This is a matter of no small importance in an engine of this size.

(*To be continued*)

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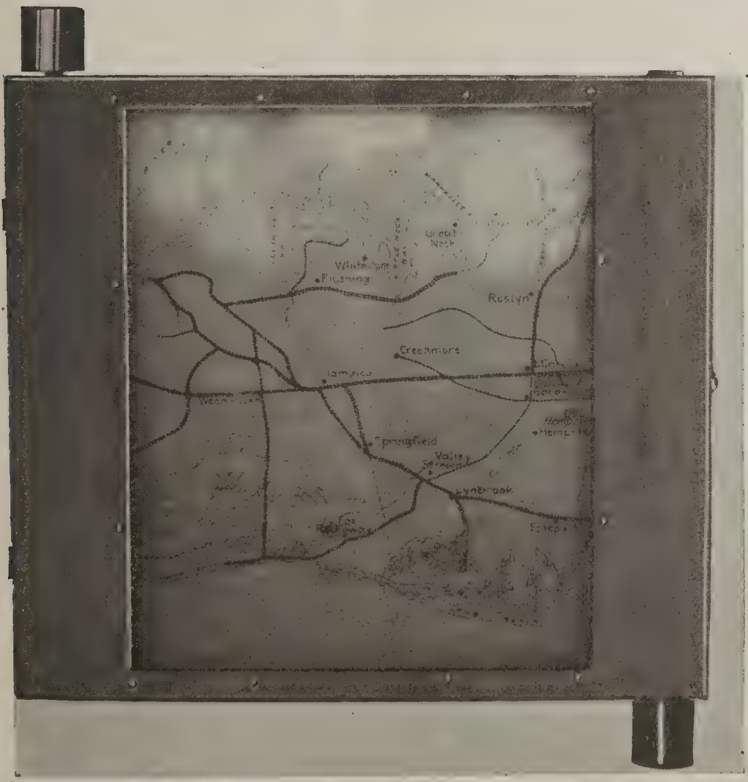


ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

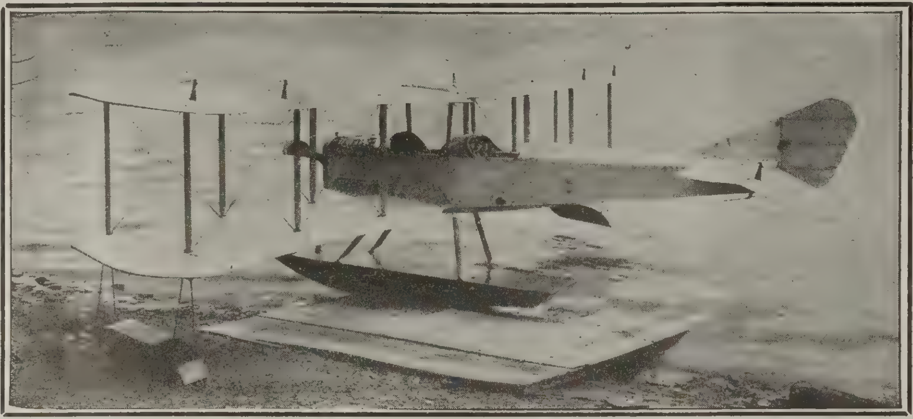
Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps, and Sperry Map Holder, supply this necessity.

The map can be turned easily in the holder bringing constantly before the aviator a chart of the locality above which he is flying.

The equipment is light in weight and can be fixed to instrument board without interference with the other instruments.

Prices and details on application.

The Aeronautic Library, 280 Madison Avenue, New York City



THOMAS NAVY HYDROAIRPLANE, TYPE SH-4.

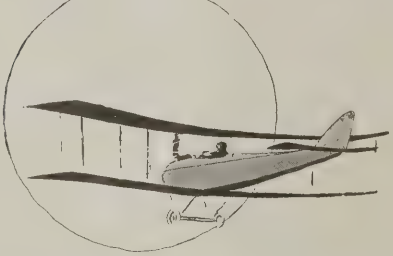
This machine has been designed particularly for **training purposes,** for either **land** or **water use.** Good inherent stability is secured by careful balance and moderate dihedral wing setting. Control surfaces are of generous dimensions to insure ease of handling under all conditions.

Speed range 40 to 65 M.P.H. with 100 H.P. engine.

Contractors to U. S. Army and Navy

THOMAS-MORSE AIRCRAFT CORPORATION

Successors to THOMAS BROS. AEROPLANE CO., INC.
THOMAS AEROMOTOR COMPANY, INC. *Ithaca, N. Y.*



Care, Diligence, Accuracy

Standard workmen are striving with a noteworthy care, diligence, and accuracy, to turn out aeroplanes of consistent performance. There is careful inspection of motors, wires, woods, metals, cloths, treatments, tuning—until qualified. Every effort is taken to make our planes dependable and trustworthy. Contractors to the United States Government. Designers and builders of the following planes:

(1) Standard "H-3" tractor biplane
(2) "J" preliminary training tractor
(3) "D" twin-motored hydroaeroplane
(4) "H-4-H" advanced training hydroaeroplane
(5) "Speed Scout" tractor biplane

Descriptive booklet sent to any address

AERO STANDARD CORPORATION

EXECUTIVE OFFICES, WOOLWORTH BLDG., N.Y.C.
FACTORY PLAINFIELD, NEW JERSEY

WANTED

Pilots, designers, mechanics, woodworkers and men to assemble aeroplanes. Exceptional opportunity is afforded to the right men by a rapidly expanding aeronautical organization. Send all information concerning experience, salary, etc.

Communications held confidential.

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Fine Factory for Rent

Within 4 Miles of City Hall, Philadelphia

This property of 11 Acres with 450 feet front on DELAWARE RIVER is near Philadelphia NAVY YARD and in close proximity to

Two Trunk Railroad Lines

The Buildings are One and Two story Brick, containing about 150,000 SQUARE FEET OF FLOOR SPACE, with ample Yard Room and POWER PLANT. LABOR Conditions are excellent. Possession can be given IMMEDIATELY.

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AVIATORS' SHOES

Light, Flexible
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We are prepared to furnish the very highest grade

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in various textures, weights and colors.

GASOLINE HOSE
MATTING
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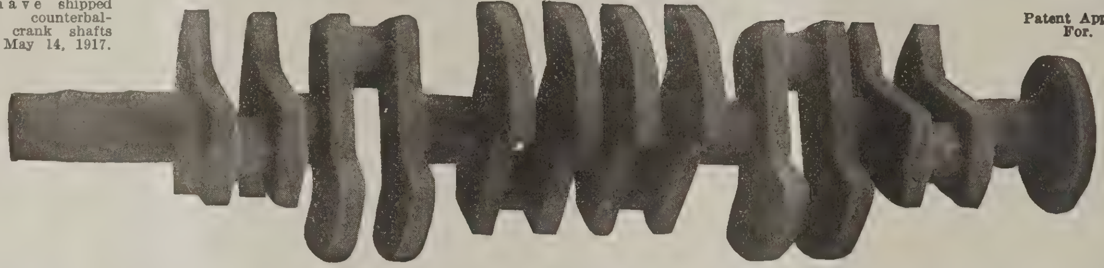
Both Ring and Cord

UNITED STATES RUBBER COMPANY
1790 BROADWAY, NEW YORK

COUNTERBALANCED

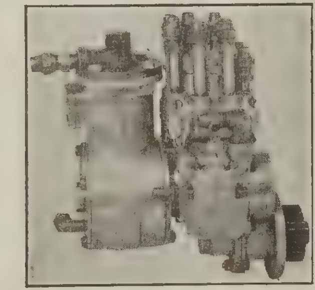
We have shipped 43,588 counterbalanced crank shafts up to May 14, 1917.

Patent Applied For.



PARK DROP FORGE COMPANY, Cleveland, Ohio

Starts High Powered Engines Cold on Low Pressure



Supplied to the U. S. Navy

THE marked efficiency of the Christensen Self Starter is perhaps best suggested by the results of a test on a Hall-Scott Motor made at the Standard Aero Mfg. plant in Plainfield, N. J. There on a tank of air of 250 pounds pressure, 28 complete starts were made without recharging the tank, and the last start was made on the low pressure of 100 pounds.

"Start Your Engine From Your Seat"
(WRITE FOR BOOKLET)

THE CHRISTENSEN ENGINEERING CO.
MILWAUKEE, WIS.

(*Continued from page* 321)

(c) *Instructors.*—Instructors must be men of experience in flying and thoroughly competent to teach through the reserve military aviator stage. They should be level headed, have good judgment, and sufficient mental balance to impart what they know.

(d) *Character of instruction.*—The course of instruction will be divided into two stages. The first stage will include instruction and qualification through and to include the preliminary flying test. This test will be held under the supervision of an officer or agent of the aviation section of the Signal Corps. The second stage, which is optional with the school authorities, will consist of advanced training necessary to qualify an aviation student as a reserve military aviator. An advanced training type of machine will be used at least during the last stages of this instruction. Detailed information as to the course to be followed in this stage will be furnished the school authorities. The reserve military aviator test will be held under the supervision of an officer or agent of the aviation section of the Signal Corps.

(e) *Preliminary flying test.*—(1) Three sets of figure eights around pylons 1,600 feet apart. In making turns around pylons all parts of machines will be kept within a circle whose radius is 800 feet.

(2) Stop motor at a minimum height of 300 feet and land, causing machine to come to rest within 150 feet of a previously designated point.

(3) An altitude test consisting of rising to a minimum height of 1,000 feet.

(4) Glides with motor throttled, changing direction 90° to right and left.

NOTE.—(1) and (2) may be executed in one flight; (3) and (4) in one flight. The same rules apply in starting from and landing on water. Special attention will be paid to the character of landings made.

Should any aviation student desire to take the pilot license test prescribed by the International Aeronautic Federation, facilities will be afforded him.

Report of these tests will be submitted to the officer in charge of the aviation section, with the information as to whether or not the school will complete the training of the aviator through the reserve military aviator stage.

If the preliminary flying test is passed satisfactorily and a candidate qualifies in other respects, he will be eligible for further instruction to qualify as a reserve military aviator.

(f) *Reserve military aviator test.*—Reserve military test will be as follows:

(1) Climb out of a field 2,000 feet square and attain 500 feet altitude, keeping all parts of machine inside of square during climb.

(2) Glides at normal angle, with motor throttled. Spirals to right and left. Change of direction in gliding.

(3) At 1,000 feet cut off motor and land within 200 feet of a previously designated point.

(4) Land over an assumed obstacle 10 feet high and come to rest within 1,500 feet from same.

(5) Cross-country triangular flight of 30 miles, passing over two previously designated points. Minimum altitude 2,500 feet.

(6) Straight-away cross-country flight of 30 miles. Landing to be made at designated destination. Both outward and return flight at minimum altitude of 2,500 feet.

(7) Fly for 45 minutes at an altitude of 4,000 feet.

If, in addition to the preliminary flying test the candidate also passes the reserve military aviator's test satisfactorily, he will be given a commission in the aviation section, Signal Officers' Reserve Corps, provided all other qualifications are fulfilled.

All candidates for the aviation section, Signal Officers' Reserve Corps, will be required to pass the prescribed physical examination, must weigh not more than 190 pounds, stripped, must furnish evidence of having a college education or its equivalent, and be of good moral character.

Applicants for commissions as reserve officers, who hold the pilot certificate of the International Aeronautic Federation may, after successfully undergoing the prescribed examinations, be given a flying examination embodying at least the requirements of the preliminary flying test. If competent they may also take the reserve military aviator's test.

25. BALLOON SCHOOLS—SPECIAL REQUIREMENTS.

(a) *Pay for tuition.*—Each balloon school will receive compensation for instruction of such personnel as may be assigned thereto, and reimbursement for average breakage to be determined in a manner similar to those at civilian aviation schools.

(b) *Character of instruction.*—The course of training will include qualification of pilots of free balloons according to the standard fixed by the International Aeronautic Federation, supplemented by practical work with captive balloons. Before qualification, balloon students must have made at least 10 ascents in captive balloons, 5 of which have been at an altitude of at least 4,000 feet. Upon completion of this course, qualified students may receive advanced instruction in the rapid maneuvering of military captive balloons by organized balloon companies at the United States Army balloon schools or during field service. They will then be eligible for commission as reserve officers and assignment to tactical units.

An application for a commission in the aviation section, Signal Officers' Reserve Corps, who holds the balloon or dirigible balloon pilot certificate of the International Aeronautic Federation may, after successfully undergoing the prescribed examinations, be given a test to demonstrate his qualifications. Provided these and all other qualifications are fulfilled he will be eligible for a commission in the aviation section, Signal Officers' Reserve Corps. As soon thereafter as practicable and with his consent he may be assigned to active duty at any Army balloon school or with a balloon company on field service for advanced training in the application of ballooning to the special requirements of the military service.

Experienced balloon pilots and candidates for commissions in the aviation section, Signal Officers' Reserve Corps, who desire training in military ballooning should submit their applications in the same manner as other candidates for reserve commissions, expressing in the letter preference for the aerostatic service. The physical, moral, and educational requirements for reserve officers of the balloon service are the same as for aviation duty. The course of technical balloon training will require about four months.

SECTION VI.

DETAIL OF OFFICERS AND ENLISTED MEN OF NATIONAL GUARD AT SIGNAL CORPS AERONAUTICAL SCHOOLS.

Par.
Applications and examinations.............. 26

26. APPLICATIONS AND EXAMINATIONS.—Officers and enlisted men of the National Guard not in the Federal Service may be detailed at Signal Corps aviation or balloon schools under section 99 of the national defense act. National Guard officers and men desiring such course will apply to the adjutant general of their State, who will forward the applications direct to the Chief, Militia Bureau, War Department, Washington, D. C. Such officers and enlisted men will be required to pass the prescribed physical and mental examinations, which will be similar to those required of reserve officers, aviation section, Signal Officers' Reserve Corps. On approval by the Militia Bureau orders will be requested from The Adjutant General of the Army assigning such officers or enlisted men to duty at aeronautical schools. Officers and enlisted men of the National Guard in the Federal Service desiring a course of aeronautical training will make application through their commanding officer to the Adjutant General of the Army, stating their qualifications for the work. Blank form of application will be furnished upon request to the Adjutant General of the Army.

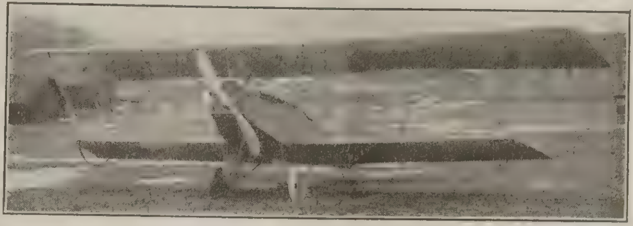
Sturtevant
(REG. U.S. PAT. OFF.)

Official U. S. Army Performance

Speed Range, 38-75 M.P.H.
Climb in excess of 3000 ft. in 10 mins.
With 2 persons and 4 hours' fuel.
Sturtevant 140 H.P. Aluminum Motor.

Unusual Load-Carrying and Safety Reserve.

STURTEVANT AEROPLANE CO.
Jamaica Plain, Boston



Burgess Primary Training Tractor Type B. P.

This machine was designed by W. Starling Burgess at the request of the United States Army for a primary training tractor aeroplane having a practical side by side seating arrangement with duplicating controls.

This has been accomplished without sacrificing in the least the efficiency or appearance of the machine.

It fills the urgent need found at present in the aviation schools—giving great range of control and allowing the instructor to be at side of the pupil during flight, thereby facilitating instruction.

This has proven very satisfactory in experimental flights as well as in the official trials thru which this machine passed with great success.

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Manufacturers of the Burgess-Dunne and Burgess seaplanes.
Sole licencees for the Dunne patents.

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Synchronized Drift Set
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Awarded Collier Trophy, 1916

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Enables Pilot to
Drop Bombs, Make Maps, Etc.
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ANNOUNCEMENT

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Guaranteed for the Most Severe Service

WYMAN-GORDON COMPANY

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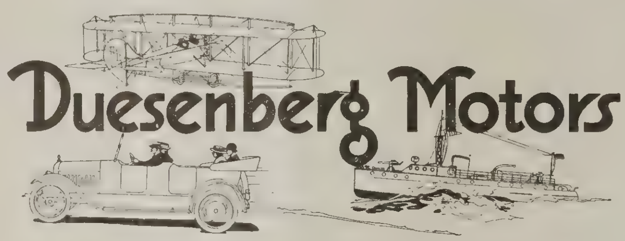

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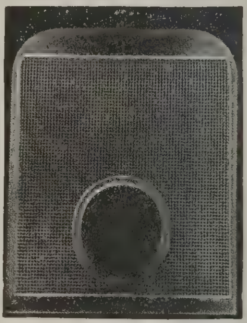

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A Labor and Time Saving Invention

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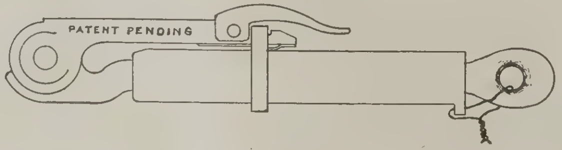

The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

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HALL-SCOTT MOTORS are offered to reputable aeroplane manufacturers as possessing those refinements in design and construction, together with consistent power delivery, under actual flying conditions, points of merit which are of absolute necessity to permit of meeting Government requirements in flying tests of the aeroplane.

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ONE PRELIMINARY LESSON - - $25.00

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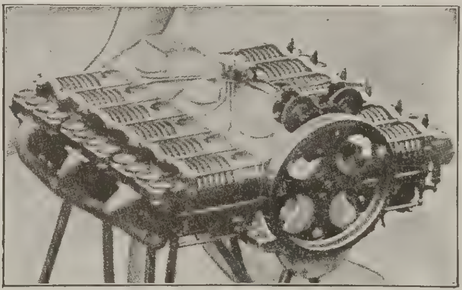

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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ARE NOW READY FOR THE MARKET
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They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
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Carburetor—Improved ASHMUSEN.
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Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11½ Gals. per hour, Low Grade.
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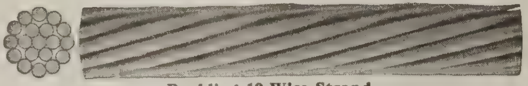
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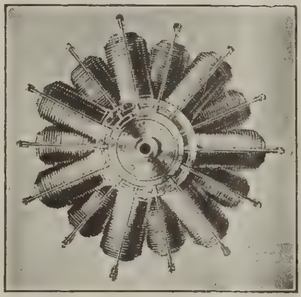

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Makes conversation possible between pilot and passenger.

Invaluable for military use because the officer can direct the pilot in scouting.

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Outfit consists of 2 Head Caps, 2 Receivers for each user, light-weight Battery and Cords. Weight complete, 5 lbs. 5 ozs. Receivers Adjustable to any type of headgear.

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Owner received delivery of the boat new from the factory at Palm Beach, Florida, on January 15th, and used it there until end of March. Since then the motor has been completely overhauled and hull revarnished. Can be seen at Port Washington Hangars, Long Island, New York.

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Forms close for this department on Monday preceding date of issue

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WANTED, AT ONCE: MOTOR, 75 H.P. OR more Curtiss O., or Hall-Scott 80, preferred, condition good. State all particulars and lowest cash price first letter. Address "G A C O" Sutherland, Iowa.

$5.00 PLANS, $2.50 FOR LIMITED TIME, or Star and Junior tractors with Nieuport Speed Scout $5.00. Engineering Course. Everything aeronautical. Chicago Aero Works, 326 River Street, Chicago, Ill.

FOR SALE: MODEL O, 75-80 HORSE Power Curtiss Motor run less than two hours. Practically new. Cost $2250.00 will sell for $1500.00. A bargain. L. L. Fisher, Geneva, Nebraska.

YOUNG MAN WITH EIGHT YEARS' EXperience driving, repairing and selling automobiles desires connection with reliable aeroplane company. Knowledge of aeronautics. Photographs and recommendations, and further information upon request. Paul D. Lyter, Harrisburg, Penna.

AIRPLANE AND MOTOR DESIGNERS, DRAFTSMEN, AVIATORS, SUPERINTENDENTS, MECHANICS. BEST MEN IN AMERICA WANTED. Write fully about yourself, experience, pay wanted, etc. Correspondence confidential. Address "Aviation," Chamber of Commerce, Detroit, Michigan.

DAVENPORT SCHOOL OF AVIATION, IS making special inducements to students as we need men for our new factory. Write today for booklet. School and Factory, Davenport, Iowa.

FIRST CLASS FOREMAN FOR METAL DEpartment aeroplane factory. State experience, salary, etc. Replies held confidential. Box 121, Aerial Age, 280 Madison Avenue, New York City.

CURTISS PUSHER TYPE BIPLANE, GUARanteed flyer, fine looper for exhibition work, good as new, complete with radiator and propeller. 60-70 H.P. Elbridge motor with high tension magneto. Price Complete $900.00. Rudolph Babler, 830 Andrus Bldg., Minneapolis, Minnesota.

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MOTOR DESIGNER AND ENGINEER WITH several years designing and manufacturing experience on high speed motors will consider new connection. My motors last year established several new World's Records for speed, won Speedway Championship, Grand Prize Race, Astor Cup Race and others. Am familiar with construction and design of the Mercedes, Peugeot, Sunbeam and other European aviation motors. Only executive position of responsibility considered. Address Box 155, Aerial Age, 280 Madison Avenue, New York City.

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MOST reasonable living expenses.

Write for particulars.

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If disaster results from engine trouble—and if that engine trouble can be traced to magneto failure—there is every probability that "NORMA" Bearings will not be found in that magneto. "NORMA" Bearings are a distinguishing feature of high-grade, dependable ignition apparatus.

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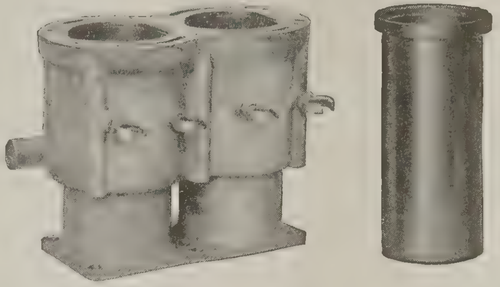

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CYLINDERS AND SLEEVE

The aluminum cylinders are cast in pairs and are carefully fitted with removable steel sleeves.

These two features contribute largely to the lightness and endurance of Sturtevant Aeronautical Engines.

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AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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REMARKABLE NEW AEROPLANE DOPE AND REAL FIRE-PROOF PAINT
that meet every standard requirement, and in addition

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Oil and gasoline spilled or splashed on plane surfaces, if ignited by engine backfire, cannot burn fabrics treated with our new dope—the fire cannot touch the fabric and will not spread beyond the oil covered area.

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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed **without** in any way affecting the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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MAY 28 1917

AERIAL AGE
WEEKLY

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Air Production Board Formed to Develop Aeronautics

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ABOUT 90% of the accidents on the training field are attributable to mistakes in landing—usually resulting in the collapsing of wheels and their supports.

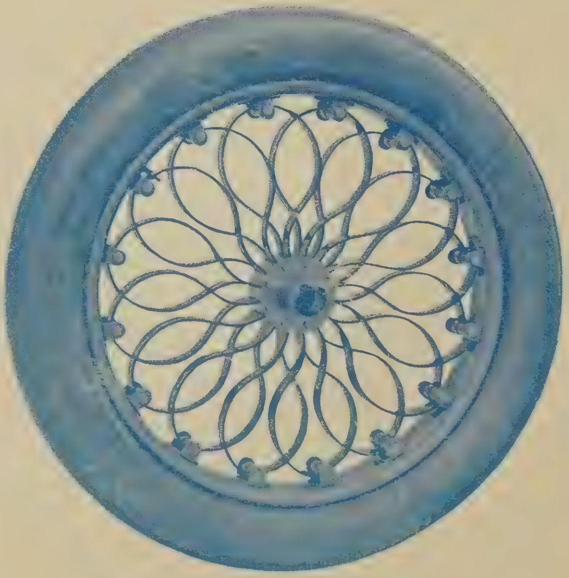
Exhaustive tests in actual service have demonstrated that Ackerman Aeroplane Wheels eliminate this source of trouble, and as soon as the inherent prejudice concerning "something new" has been eliminated, every machine that is produced in this country will be equipped with Ackerman Wheels.

Beyond the greater factor of safety which the Ackerman Wheels insure, they have many other points of advantage over the ordinary types of aeroplane wheels.

First: They are lighter in weight.

Second: They are constructed in such a way that they can be streamlined more efficiently.

Third: Their wonderful strength and resiliency are best evidenced by their ability to absorb shock and prevent rebound in landing and getting away.



Ackerman Wheels are built in different sizes to carry any load from 500 pounds and up

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"Automatically Operates All Controls"

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for
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In 1916
for
Sperry Synchronized Drift Set

THE SPERRY GYROSCOPE CO.

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126 Rue de Provence—PARIS

Synchronized Drift Set

"Automatically Corrects the Compass for all Drift"

Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities

THE CURTISS AEROPLANE CO., Buffalo, N. Y.

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WEEKLY

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THE TRADE AUTHORITY

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Vol. V NEW YORK, MAY 28, 1917. No. 11

AIR PRODUCTION BOARD FORMED TO DEVELOP AERONAUTICS

Orders Being Placed for 3,500 Aeroplanes and Steps Taken to Begin Training 5,000 Aviators

AN Air Production Board has been established at last to take up in an energetic way the work of developing our aerial defenses. We give herewith the first announcement of the preliminary plans, which are at present handicapped by lack of sufficient appropriations.

The limitations imposed by insufficient appropriations are serious, but the Aero Club of America and its constituent organizations are pledged to carry out an extensive campaign of public education, if necessary, to make Congress realize the necessity of allowing the appropriations to enable us to make a substantial start, and which will permit looking forward to the production of the 20,000 aeroplanes needed to train and equip the 5,000 aviators in the shortest time possible.

It has been estimated that it takes an average of half an aeroplane for each aviator trained, and that even with the utmost care 25 percent of the student aviators do not become military aviators, and have to be divested to other branches of the air service, where they do not have to pilot an aeroplane, although their services are of equal importance. Therefore, there will be required, roughly speaking, 5,000 aeroplanes to produce 5,000 military aviators, allowing the difference between one-half an aeroplane to each student and the 5,000 mentioned for those that will not qualify as aviators and the training of observers.

As a military aviator must now be able to pilot an aeroplane going at a speed of close to 120 miles per hour, there will be an intensive training required with fast machines, which will undoubtedly increase largely the number of machines needed for the training of the 5,000 military aviators.

After the aviators are trained there will be required three aeroplanes to equip each aviator, making 15,000 additional aeroplanes needed for equipping the aviators and making a total of 20,000 aeroplanes needed within two years.

The personnel of the newly appointed Air Production Board is as follows:

Howard E. Coffin, chairman; Brig-Gen. George O. Squier, signal officer, U. S. A.; Chief Constructor Taylor of the navy, S. D. Waldon, Major in the Officers' Reserve Corps; E. E. Deeds, former general manager of the National Cash Register Company, and R. L. Montgomery of the Philadelphia firm of Montgomery, Clothier & Taylor, who will serve as financial and business adviser.

Mr. Coffin is a Governor of the Aero Club of America, and as will be remembered was chairman of the Organizing Committee of the First Pan American Aeronautic Exposition. General Squier and Messrs. Waldon and Deeds are also members of the Aero Club of America. Mr. Waldon is a Major in the U. S. Army Aerial Reserve Corps, and Mr. Deeds gave a demonstration of his practical patriotism recently by offering to establish training camps for aviators.

The preliminary announcement of the Air Production Board is as follows:

"We now believe America has started on the right road toward working out her destiny in the air and taking the place to which her capacity entitles her and which the world expects of her. We have been in constant touch for weeks with the aircraft manufacturers on the problem of the quantity production of machines, and the Government authorities are already signing contracts for as many machines as our present appropriation permits. The United States can depend on a minimum of 3,500 aircraft of all types the first year, if Congress authorizes us to proceed. The program we now have in mind would provide for both training and combat machines.

"Only a few American manufacturers are in a position to handle large contracts, but European orders for training machines within the last two years have helped in some measure to overcome a tremendous disadvantage existing at the beginning of the war.

"In building battle planes the engine is the chief problem. American manufacturers are now conducting successful experiments with both new and foreign types; and we are confident that we shall be able to develop within the year the manufacture of motors of sufficient power and endurance for use at the front. It is a matter of common knowledge that up to this time, with few exceptions, the only machines which America has turned out for use abroad have been training types.

"Whether we turn out large numbers of machines fast and powerful enough for use at the front or not, however, all that we manufacture will be of value to the Allies, since the more training machines we turn out here the more factories in England and France are released for the manufacture of fighting machines. It is highly probable, indeed, that our shipments abroad may consist at first largely af aircraft engines, since they are compact, and shipping whole planes might easily require more shipping space than the Allies would wish to give up to that purpose.

"Arrangements have been made with British and Canadian officers to standardize the training machines in use in Great Britain, Canada, and the United States, so that machines can be distributed impartially and without difficulty among the three nations. We hope to be able to make satisfactory arrangements with the British and French manufacturers to secure the advantage of their experience and designs in spurring forward the development of our own industry. All reports that the United States intends to purchase aeroplanes abroad are manifestly false, since the Allies are constantly in need of more machines than their own resources can supply.

"The country has made progress in developing aviators. Last month a group of army officers visited the training camp of the Royal Flying Corps at Borden, Ontario, one of the four camps established in Canada and the aviation school at Toronto, where cadets are trained under military discipline for the service. In these schools there has been incorporated the latest European experience in the development of this new art of the air.

"Our officers were deeply impressed with their observations, and as a result we called together here the heads of six prominent engineering schools which also have military training, and made plans to establish a similar system in the United States. The six institutions are the Universities of California, Texas, Illinois, Ohio, Massachusetts Institute of Technology, and Cornell University. Three technical instructors from each of these places were sent to Toronto. They returned on May 8 after a comprehensive study of the course given there, prepared to teach it themselves. On May 10 these six engineering schools opened similar cadet aviation schools at their respective institutions. At the end of two months of this preliminary work, the cadet is given a final test to determine whether he shall go on to the aviation camp.

"General Squier's office has been handling these schools, over which Professor Hiram Bingham of Yale has been given general direction, and there have been far more applicants than could be admitted. Twenty-five cadets a week are entering each of the six colleges, which means that as soon as the first entering class completes its preliminary work approximately 150 students a week will be available for the regular training camp. There will be 600 cadets in the six colleges by July 1.

"In the meantime plans are going ahead for the nine aviation fields to receive the men when they are ready. The standard field on which we are basing our program will provide for accommodating two squadrons of 150 students each, with the necessary officer instructors and enlisted men, together with a certain number of additional enlisted men who will be training at the same time. The hangars will take care of 72 planes. The preparation of these fields will cost approximately $1,000,000 each, including the construction of the necessary buildings, dormitories, workshops, and hangars. The fields will be approximately a mile square.

"We are estimating about four months as the period for getting those students ready for army service. The Aircraft Production Board is working hard to assist the military departments in their plans to have all these related activities co-ordinated. These new plans will not interfere in any way with the present use of the four aviation fields the Government now has, nor with private initiative. It is doubtful if the Government can make any particular use at present of private fields, because they are not training their men under military discipline.

"The manufacturing capacity can easily be doubled the second year. A prominent British General has asserted that America's greatest contribution to the war will be aircraft and aviators. We believe that, once started upon quantity production, American mechanical genius will overcome any present obstacles to the progress of the art."

1,800 AEROPLANES NOT TO BE ORDERED FROM FRANCE

On May 15th a Washington despatch was printed in the press throughout the United States that orders had been placed in France for 1,800 aeroplanes for the United States Army. This report was received with a general feeling of misapprehension by the public and press of the United States, and the Aero Club of America immediately entered a vigorous protest. The protest stated that this project would place additional burdens on our Allies instead of helping them, and would further delay the work of establishing sources of supplies for military aeroplanes in this country.

The protest, which is signed by Mr. Alan R. Hawley, President of the Aero Club of America, is addressed to Secretary of War Baker, Secretary of the Navy Daniels, the Council of National Defense, the National Advisory Committee on Aeronautics, the Chairman of the Committee on Military and Naval Affairs in both Houses of Congress.

The protest quotes Mr. André Tardieu, the newly appointed High Commissioner for France in the United States, and Mr. Pemberton-Billing, a member of the British Parliament, who have been urging that the United States assist the Allies by supplying to the Allies between 5,000 and 10,000 aeroplanes as soon as possible.

It is also pointed out that insofar as equipping American aviators with fast fighting planes is concerned, we must give these men the six months' training necessary to train them to the point where they can handle machines capable of going at a speed of 115 miles an hour, which is the speed of the present American aeroplanes.

The letter sent to Secretary Baker and the other officials mentioned reads as follows:

"Dear Mr. Baker—

"(1) We beg to submit that the plan to place orders in France for 1,800 aeroplanes for United States aviators places an additional burden on our Allies instead of helping them and will greatly delay the establishing of sources of supply for military aeroplanes in this country.

"(2) We have given close consideration to the subject and find that our Allies agree in the advisability of immediately developing manufacturing facilities in the United States to supply them with a large number of aeroplanes thereafter. M. André Tardieu, the newly appointed High Commissioner for France in the United States, who is a member of the French Chamber of Deputies, and knows the extent of the manufacturing resources of the United States, in his statement to the press dated, April 28, said:

"'As regards war material, there is one thing in which the United States could collaborate at once—the manufacture of aeroplanes. French specialists should be sent over to give American workers the finishing touches in certain processes in which the latter are wanting. The motors, as an instance, hitherto delivered by the United States, have not the same finish as those made in France. All American factories able to take part in such production should be set to work at once. An inventory of those able to make aeroplanes must be made. It may be said that we have not enough technical workers to spare, but if a short slackening in our output can assure us in four months five or six times greater results, should we hesitate? It is a question of figures, calculations and estimates.'

"In the British House of Commons on April 26th, Mr. Pemberton Billings, a member of Parliament, in an address urging the British Government to co-operate with the United States in developing sources of supply for aeroplanes in the United States, said:

"'It would be quite possible for the American nation without any great strain on their resources either of personnel or of material, to raise 5,000 or 10,000 bomb-dropping machines in the next six or eight months. I think it also feasible that they might be able to provide at least half that number, which would be a very fair average to allow for crashes; and, I think, if this war does continue through this year, as it seems likely to continue, it would be a very useful thing for the Allies if the Americans could put from 3,000 to 5,000 bomb-dropping machines on the Western or on the Eastern front early next year. The effect of raids carried out on a vast scale, as they could be carried out, without any trouble to ourselves or any drain on our resources beyond supplying America with the drawings and specifications and possibly one or two machines to help them through the initial stages, would be incalculable.'

"(3) We beg to suggest that whereas the U. S. Army has just adopted the British and Canadian system of training aviators, which involves putting every student through a course of training requiring from six to nine months, as stated by the National Advisory Committee on Aeronautics, we can turn out fighting machines in large numbers long before we have the aviators to fly them.

"(4) As a matter of fact, an aviator trained to fly the present fast American aeroplanes, which have a speed of up to 115 miles an hour (and a high factor of safety of six) will have no trouble whatever in piloting the lighter European machines, which have a speed of 120 miles per hour, but have only a factor of safety of two. When fighting the enemy aviators this additional five miles an hour is of vital importance, but for training to the fighting point the American machines are best, as they bring the same results, without involving the aviators into risking their lives in training with the lightly built European machines.

"Assuring you of the hearty co-operation of the Aero Club of America and its thirty constituent aero clubs in every way in which we can assist in the upbuilding of our national defenses, I remain,

"Yours very sincerely,
(Signed) Alan R. Hawley, *President,*
"Aero Club of America."

TWO BILLION DOLLAR LIBERTY LOAN AERIAL RALLY PROPOSED—AERO CLUB OF AMERICA OFFERS $10,000 IN LIBERTY BONDS AS PRIZES

The assistance of the Aero Club of America and its thirty constituent clubs has been requested by the Liberty Loan Committee for a campaign of education on behalf of the United States Government two billion dollar war loan and, as part of this campaign, it is proposed to have a race across the continent over the Lincoln Airway, which extends from New York to San Francisco. The Aero Club of America has already done energetic work on behalf of the Liberty Loan and has invested close to forty thousand of the club's funds and prize funds in Liberty Loan bonds. Many of its wealthy members have also subscribed extensively in Liberty Loan bonds.

The plans for employing aeroplanes in the campaign of public education on behalf of the Liberty Loan were discussed by the officers of the club and representatives of the Liberty Loan Committee two days ago, and this morning Mr. Alan R. Hawley, president of the Aero Club of America, received the following letter from Mr. Burnett Townsley of the Committee on Publicity Education of the Liberty Loan Committee, of which Mr. Frank A. Vanderlip is chairman:

"Alan R. Hawley, Esq.,
"President, Aero Club of America,
297 Madison Avenue, New York City.

"Dear Mr. Hawley:

"Confirming our conversation, the Liberty Loan Committee invites the cooperation of the Aero Club of America and its constituent clubs, in a campaign of public education on behalf of the United States Government $2,000,000,000 war loan.

"Our Committee is particularly interested in the plan suggested by Messrs. Henry Woodhouse and Augustus Post to run a race across the continent over the Lincoln Airway. We are also interested in the plan to make an aerial circuit of the country, as it were, by sending aviators from each of the military and civilian aeronautic stations to other points, so as to practically touch simultaneously the important geographical points by aeroplanes carrying educational pamphlets and circulars relative to this patriotic enterprise during the week of June fourth.

"As this campaign of public education is undertaken by direction of the United States Treasury Department, we believe that it will be possible to secure effective cooperation of the Army and Navy Aviation Sections.

"Therefore, may we urge you and your Board of Directors to appoint at your earliest opportunity a committee to consider the advisability of conducting such a race and to suggest other ways and means by which your excellent Club and its constituent clubs may cooperate with our Committee in this patriotic service.

"Your suggestions and advice will be heartily appreciated.

"Very truly yours,
"LIBERTY LOAN COMMITTEE,
"By Burnett Townsley."

The Executive Committee of the club is communicating with its thirty constituent aero clubs and appointing the committee to carry out a nation-wide aerial campaign for public education on behalf of the two billion dollar war loan.

If possible, the Liberty Loan Aerial Rally will be conducted during the week of June 4th, the day selected by the Liberty Loan Committee, which will make it possible to

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THE NEWS OF THE WEEK

The D N-1 in Use at Pensacola

Washington.—The first dirigible balloon to be used by American military forces is in operation at the Pensacola Naval Aeronautic Station. It is known as D N-1, and is being used to train crews to handle the fleet of sixteen coast defense dirigibles soon to be delivered by the builders.

Thousands of men from all parts of the country have applied for enrollment in the Naval Reserve Flying Corps. Since only a limited number of men was desired, the Department has been able to select with great care the men it desires.

S. A. E. Summer Meeting at Washington

Definite plans concerning the summer meeting of the Society of Automotive Engineers, to be held June 25 and 26 at the Bureau of Standards. Washington, were settled at the May meeting of the Council of the Society, which was held in the new S. A. E. offices in the Munsey Building.

An informal dinner will be held in the banquet hall of the New Willard Hotel, Tuesday evening, June 26. Secretary of War Newton Baker has accepted an invitation to be present and address the engineers. The other speakers have not been dcided upon as yet. The dinner will be $6.00 per plate, and members are asked to make reservations through the New York office of the S. A. E. It is expected that this dinner will be the greatest get-together of the Government officials and S. A. E. members in the history of the Society. Over thirty guests representing the Army and Navy from Washington will be present.

The professional session on Tuesday, June 26, will be one of particular interest. The majority of the papers to be presented have already been decided upon, and they all will be of a practical type. Wing Commander I. W. Seddon, R. N. A. S., who is a member of the British Commission in this country, and who is demonstrating some of the British types of war aeroplanes here, has agreed to present a paper dealing with the practical aspects of airplane manufacture, and to include much other information greatly needed by manufacturers and engineers. Commander Seddon has had much practical experience on the Somme Front.

Major Rees, also of the British Commission, an experienced British aviator throughout the entire Somme Campaign, who accompanied the Commission to give practical information on what aeroplanes of different types are actually called upon to do, has practically agreed to answer various questions on this interesting subject.

Anti-Aircraft Gun Battery Has First Drill

Fifty members of the Brooklyn Battery of the First Anti-Aircraft Regiment were drilled in the armory of the Twenty-third Regiment, Bedford and Atlantic Avenues. It was the first drill of the organization, which has five batteries in Manhattan and Brooklyn. The men are working on the lines of a similar organization in London. Guns have been ordered, and it is expected that the men soon will be instructed in their use.

Large Training Camp at Wilmington

A large aviation training camp for training men for the Army and Navy Aerial Reserves is being established by Messrs. Pierre DuPont, Irenee DuPont and J. J. Roskob, of Wilmington, Del., and the Aero Club of America's co-operation and advice has been requested, and the Club is asked to refer students to be trained free of charge.

Authoritative details regarding this plan are made public for the first time in the letter addressed to the Board of Governors of the Aero Club of America by Mr. Harry N. Atwood, the veteran aviator and aeronautic engineer, who has been appointed in charge of this school. The letter follows:

"The Board of Governors, Aero Club of America,
New York City.

"Gentlemen: To help the Government in getting aviators for the Army and Navy Aerial Reserves, Messrs. Pierre DuPont, Irenee DuPont and John J. Roskob decided recently to establish an aviation camp and train men suitable for the air service free of charge.

"Steps were promptly taken to carry this plan into effect and establish a land and water aviation training school. The site for the aviation field, which is located at Claymont, at the edge of the Delaware River, is part of Mr. J. J. Roskob's estate. It is splendidly located, affording facilities for both land and water flying.

"The preliminary equipment is to consist of six aeroplanes and seaplanes, with the necessary spare parts and spare motors. This equipment has been ordered, and delivery of four of the machines is to be made within a few days.

"The aviation school is to open on June 1st, and the plan is to put under training as soon as possible fifty students.

"As the purpose of Messrs. DuPont and Roskob in establishing this aviation training school is to assist the Government by giving preliminary aviation training to suitable men, the candidates for the training will be required to pass the physical examination prescribed by the Army and Navy for aviators, and will be men having a college education or its equivalent.

"The co-operation of the Aero Club of America in carrying out this plan will be greatly appreciated. As the Club has done so much in the past towards getting and training aviators for the Reserves, you are in a position to make valuable suggestions resulting from your experience, and to refer to us suitable men who have applied to the Club for aviation training.

"Kindly refer applicants to the writer, who is in charge of this project. My address is Hotel DuPont, Wilmington, Del.

"Assuring you that your co-operation and advice will be greatly appreciated, I remain,

"Very sincerely yours,
(Signed) "HARRY N. ATWOOD,
General Manager."

It will be remembered that Harry N. Atwood was one of the first few original American aviators. In 1911 he made the then extraordinary flights from St. Louis to New York, and Boston to Washington. In the St. Louis flight he covered a distance of 1,265 miles, and in the Boston to Washington flight, he covered 818 miles. On his arrival at Washington he landed on the White House grounds, being the first aviator to land on the White House grounds.

Standard Aero Corporation Offers Machines to Civilian Organizations

The management of the Standard Aero Corporation has asked AERIAL AGE to announce that in order to encourage and increase aviation training, Government officials have authorized the sale to private parties of Standard Model "J" Training Machines, built for the Government to full specifications, and passed by Government inspectors. The "J" has a high factor of safety, and is equipped with a special safety landing gear, as shown, which prevents nosing over. It has a low landing speed of 37 m.p.h. Several of these machines that have passed Government inspection are now complete and ready for immediate delivery from the Standard Aero factory at Plainfield, New Jersey. A large number of these are being built for the Government use, thus assuring quick deliveries of spare parts.

Admiral Peary in Chicago

Rear Admiral Robert E. Peary spoke at a dinner given by the Aero Club of Illinois on Friday evening, May 18th. The subject of his talk was "What America Needs in Aeronautics." Admiral Peary's emphatic expressions in favor of a separate department for aeronautics in our military system met with enthusiastic approval from Chicago aviation enthusiasts. His utterance in favor of an aviation reserve which would permit of the enrollment of men from mechanical, but not necessarily educated classes, also met with hearty approval. Charles Dickinson, President of the Aero Club of Illinois, in emphasizing this latter point, indicated numerous instances where the gift of the birdman often had been found in men of comparatively little education.

New Duesenberg Plant

New York.—The Duesenberg Motors Corp. has filed plans for the construction of a plant in Elizabeth, N. J., for the manufacture of aeroplane engines for the Government. The plant will be in Newark Avenue and will cost $20,000. The company has been forced to seek larger quarters. It has been occupying a plan at Edgewater temporarily.

It is believed that the new plant will be the largest in the East, being one story, and employing more than 1,000 men. The company has bought 9½ acres of land in Elizabeth.

McCall White Resigns from Cadillac

Detroit.—D. McCall White, chief engineer of the Cadillac Motor Car Co., has resigned. No announcement has been made as yet regarding his successor. It has been reported that Mr. White has designed an aeroplane engine in which the Government is interested, and that this is the cause for his resignation. Mr. White was chief engineer of the Napier Motor Car Co. of England prior to his connection with the Cadillac company. For the past year he has been chairman of the Detroit section of the Society of Automotive Engineers, and he is a director of the Aero Club of Michigan.

Interested Army witnesses of the activities at one of the American training fields

Army students and instructors getting ready for the American offense in Europe

Washington University Has Course in Aeroplane Building

Seattle.—For the benefit of students of the University of Washington who desire to enter the aviation section of the signal corps, a course in aeroplane construction is being offered by J. W. Miller, assistant professor of civil engineering at the state university.

The series will continue throughout the rest of the present semester and will deal with the following subjects: Types of aeroplanes, monoplanes and multiplanes; aeroplane details; stability, static and dynamic essentials of design; flight and aeroplane instruments; the aviation section of the signal corps of the United States army, and the complete working details for the building of an aeroplane.

No credit is given for the work and there are no prerequisites. Persons outside the university may arrange to take the work.

Fay L. Faurote Addresses Buffalo Ad Club

Buffalo.—Fay L. Faurote, advertising manager of the Curtiss Aeroplane Company, addressed the Ad Club at a luncheon in the Hotel Iroquois recently and showed a series of slides that traced the history of aeroplane construction from the time when the idea of flying was conceived.

Mr. Faurote showed the various types of aeroplanes made in the last several years and the improvements effected in the modern machines.

Indianapolis University Arranges Course in Aeronautics

Indianapolis.—In response to the rapid progress which the science of aeronautics has made and to the interest which the present war has developed in the subject, the extension division of Indiana university announced that a short course of six lectures will be given in Indianapolis on aeronautics. The course will begin May 11 and continue for six weeks, with one lecture each week. The lectures probably will be given in the Chamber of Commerce building.

Tobias Dantzig, of the department of mathematics of Indiana university, will have charge of the course. He is a graduate of the University of Paris, and has taken a special course in the "Ecole Superieure d'Aeronautique" of Paris. Mr. Dantzig is giving a course similar to the one which he will give here for the recently organized Indiana university Aero Science Club at Bloomington.

U. S. Army Flier Killed on Border

El Paso, Tex.—Lieutenant Melchior Eberts, United States Army Aviation Corps, was killed May 15 by a fall with his aeroplane during a flight at Columbus, N. M., according to a telegram received at divisional headquarters here. Captain James L. Dunsworth, who was in the machine with Lieutenant Eberts, was injured, but will recover, his physician reported.

The aeroplane fell from a height of 1,500 feet. The accident was attributed to atmospheric conditions resulting from the altitude and the dryness of the region about Columbus, the machine having been caught in an air pocket.

Packard Aeronautic Activities

Detroit.—A variety of stories rearding the aeranautic activities of the Packard Motor Car Co. have been circulated, the latest being on a supposed high-speed plane that the Packard company was said to intend building. Aerial Age is able to state authoritatively that the Packard Motor Car Co. has given up the idea of making planes, as it is going to turn its entire attention in this department to the manufacture of aeroplane engines.

A group of aeronautic authorities at one of the aviation fields. Lieut.-Commander John H. Towers is shown in the center, wearing a derby hat, and Fay L. Faurote, chairman of the Censorship Committee of the Aircraft Manufacturers' Association

Pensacola News

The trial flights of the great Curtiss H-12 flying boat aroused much interest. Several very successful flights were made.

The new Navy dirigible—DN-1—which has been exciting the curiosity and straining the expectancy of the entire Station and of Pensacola for these many months, has taken its trial flights in the most approved manner. Sailing high over the Bay and the City, it was an object of admiration to all.

We note the transfer of Lieut. M. A. Mitcher to the U. S. S. "Huntington," where he is to take charge of the catapult and the aeronautic work. Lieut. Mitscher has been prominently connected with the engineering work at this Station, both as officer in charge of the machine shop in the trying days of the "North Carolina's" catapult installation, and later as Engineer Officer. Recently, as one of the Flying Instructors, he has spent many hours in the air. In view of the excellence of his past record, we feel safe in prophesying all success for Lieut. Mitscher in his new assignment.

A Hint on Landing

One of the little known dangers attending land flying is that the color of the landing field has its effect upon the machine. Land which is dark from being plowed or burned over will heat the air over it faster than will a field of stubble, the difference being due to the varying absorption and reflection of sunlight. A landing place which has an area of heated air above it is dangerous, as the air disturbance gives insecure support for the planes. One aviator told of attempting such a landing and being tossed upward by a warm current when he had almost reached the ground.

Naval Reserve F. C. News

Lieut. Edward O. McDonnell has been detailed as Naval Instructor in charge of Units Nos. 1 and 2, U. S. Naval Reserve Flying Corps. Beside the regular flying instruction, Lieut. McDonnell has instituted formation flying with six machines. A coastal flight from Palm Beach to Miami was planned for April 22d, but had to be called off on account of the inclement weather. All necessary precautions were taken in case of accident. Three automobiles and a motorcycle were to have convoyed the squadron down the coast, the local authorities having waived the speed laws for the occasion. At several points, motor boats were to have been stationed five miles off shore to render assistance if necessary, and to pick up messages which were to have been dropped from the planes in flight.

Flying hours are from six to ten a. m., and from three to six p. m. Between times, Lieut. McDonnell gives lectures on theoretical aeronautics, seamanship, navigation and naval etiquette. Instruction is also given in radio and in the different methods of visual signalling.

Acieral Metal

Acieral is a new metal, containing 97% aluminum, introduced and manufactured by the Acieral Company of America, 26 Cortlandt Street, New York City, at their Newark N. J. foundry. In importance the creation of Acieral takes rank at once among the foremost of human achievements. The production of steel with its marvelous strength was a triumph, the value of which has never yet been computed. The reduction of aluminum with its astonishing lightness in commercial quantities was a stroke of genius almost without parallel. But steel is heavy; aluminum is weak. The creation of ACIERAL, a chemical union combining the strength of steel with the lightness of aluminum—who shall say that this does not mark the crowning achievement of the metallurgist's art?—the discovery of a universal metal. The uses to which this metal can be put are limitless, and on account of its strength and lightness and no-corrosive qualities it is particularly suitable for use in the construction of all classes of aircraft. It is silver white in color, is said not to oxidize either in air or water, fresh or salt, has a specific gravity of 2.82 and a melting point of 1382 deg. Fahrenheit. Its tensile strength in castings is 22.000/28.000 lbs. per square inch with elongation of from 0.5 to 5 per cent. In rods and sheets the tensile strength runs from 28.000 to 64.000 lbs. per square inch and when tempered to over 72.000. Reduction of area: from 10 to 35% according to specification. It can be sand cast, die cast, hot and cold forged, annealed, drawn, stamped, hardened by temper and soldered, etc.

It is also claimed that it withstands well the action of all acids, hot or cold, except hydrochloric.

Acieral is furnished in the form of ingots, castings, plates, rods, wires and tubes.

The present plant of the Acieral Company of America has a daily capacity of 10 tons and has now been in operation for about two months.

First Aero Corps to France Soon

Inquiries at the Aero Club of America regarding the statement of the French War Minister, M. Paul Painleve, in which he says that the United States is sending airmen to France, brought out the fact that for the past two days the Aero Club of America has been the recruiting office for the personnel of the First Reserve Aero Squadron which is to be sent to France as soon as the recruiting is completed.

The First Reserve Aero Squadron is to be commanded by reserve aviators who were trained at Governors Island and Mineola during the past year, including Major Raynal C. Bolling, Capt. Philip A. Carroll, Capt. James E. Miller, First Lieut. Daniel R. Noyes, Frederick T. Blakeman, Charles Reed, Hobart A. H. Baker and Edwin M. Post, Jr.

A few days ago the Aero Club of America called for mechanics to make up the enlisted personnel of this aero squadron, for which are needed 154 men, and it is desired to get as many expert mechanics as possible. There was quite a substantial response to the call, but as it is desired to have mostly expert mechanics, the Club is still calling for men with expert knowledge of gasoline engines. The men who will go to France with this First Aero Squadron will, of course, make history, and they will have the opportunity of getting a special course of training in gasoline engines and the mechanical part of aeronautics under the very best French experts. Their pay is from $36 to $75 a month, with 20 per cent additional for foreign service, with all clothing, food and transportation in addition.

The War Department and the Aero Club authorities have been receiving many applications from aviators, military and reserve, who would like to go to France; in fact, the applications are so numerous that several aero squadrons could be formed right away to go to France. There is also a large number of applications from college men from all over the country who would like to take aviation training immediately to join aero corps going to France.

Prominent Americans Join French Aero Corps

Eight young Americans of prominent families have left for a port in France to join the Lafayette Flying Corps, the famous organization of picked Americans, of which William Thaw is a member. Five of them are graduates of Harvard and Princeton Universities, and they and their three associates were selected from among 100 applicants who were eager to fight in the air in France for the cause of the United States and her Allies. They are:

William Henry Meeker, of New York, Harvard, A. B., 1917, and formerly member of the editorial staff of The Crimson, Harvard's daily newspaper.

Vernon Booth, Jr., of New York, Harvard, A. B., 1913, who left a law practice in the city to join the flying squadron.

Cyrus F. Chamberlain, of Minneapolis, Minn., Princeton, A. B., 1915, son of F. A. Chamberlain, head of the First and Security National Bank of Minneapolis.

Benjamin Stuart Walcott, Princeton, 1917, son of Charles D. Walcott, Secretary of the Smithsonian Institution, Washington, D. C.

Samuel W. Wiggins, Cincinnati, Harvard, A. B., 1915, and member of a banking firm.

Ted Ford, member of a prominent Washington, D. C. family.

Roger Harvey Clapp, Salt Lake City.

Ferchar I. Ferguson, of New York, who drove an American Red Cross ambulance behind the Allies' front near Dunkirk for nine months in 1915. He is related to the Armours, the packers.

Each of the eight was examined for "air sense" and for general ability to handle a battle plane before being accepted. Meeker took daily practice for three weeks in the Thomas Morse Aviation School and proved himself peculiarly fitted for the work. Walcott flew with the late Victor Carlstrom, who recommended him for the service.

On arriving at Paris the aviators will present their credentials to Dr. E. L. Gross, the director of the corps, and after being examined and trained they will go to the front with Lieutenant Thaw and Adjutant Raoul Lufbery.

New Sub-Committees of the Council of National Defense

The following new sub-committees of the Council of National Defense with their personnel were announced on May 9. The steel sub-committee consists of Judge E. H. Gary, James A. Farrell, Charles M. Schwab, James A. Burden, E. A. C. Clarke, president Lackawanna Steel Co.; Alva C. Dinkey, of the Midvale Co., and W. L. King and John A. Topping, of the Republic Steel Co. A. C. Bedford, president of the Standard Oil Company, heads the sub-committee on oil. Chairmen of other committees are Horatio S. Rubens, director of the U. S. Industrial Alcohol Co., alcohol; Arthur V. Davis, aluminum; Charles F. Brooker, brass; W. H. Childs, coal tar by-products; R. H. Dowmen, lumber; Clinton H. Crane, lead; L. W. Kingslay, mica; Ambros Monell, nickel; H. Stuart Hotchkiss, rubber; Henry Whinton, sulphur, and Jacob F. Brown, wool.

Army and Navy News

The following-named officers of the Aviation Section, Signal Officers' Reserve Corps, are assigned to active duty; they will proceed to Governors Island, N. Y., and report in person to the commanding general, Eastern Department, for duty in connection with the organization of the First Reserve Aero Squadron, Signal Corps: Maj. Raynal C. Bolling, Capt. Philip A. Carroll, Capt. James E. Miller, First Lieut. Daniel R. Noyes, First Lieut. Frederick T. Blakeman, First Lieut. Charles Reed, First Lieut. Hobart A. H. Baker, First Lieut. Edwin M. Post, Jr.,

Under the provisions of paragraph 38, Regulations for the Enlisted Reserve Corps, the following sergeants of the Signal Enlisted Reserve Corps, now on duty at the Curtiss Aviation School, Miami, Fla., will be discharged by the Chief Signal Officer of the Army, by reason of their services being no longer required: Robert Matter, Stanton T. Vanderbilt, James W. Junkin, Ben T. Myers, Russell MacDonald, William H. DeWald, William B. Rodgers, Jr., Dunn K. Steele, Wallace D. Culbertson, Allyn R. Jennings.

First Lieut. Fred A. Post, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty. He will proceed to Fort Omaha, Nebr., and report in person to the commanding officer, United States Army balloon school at that place, for duty.

Capt. Virginius E. Clark, junior military aviator, Signal Corps, will proceed to Detroit, Mich., for temporary duty in connection with aeronautics of the Army, and upon the completion of this duty will return to his proper station in this city.

Major Frank P. Lahm, junior military aviator, S. C., from San Diego, Cal., to Fort Omaha, Neb., and assume command of the U. S. Army Balloon School. (May 9, War D.)

Sick leave one month to Capt. Benjamin G. Weir, junior military aviator, S. C. (May, 10, War D.)

Sergts. 1st Class Harry V. Hand and Clarence H. Maranville, S. C., to Essington, Pa., for duty. (May 8, War D.)

Sergt. 1st Class Alexander B. Culp, S. C., Fort Sam Houston, Texas, to Buffalo, N. Y., for not to exceed three months for instruction at the Curtiss Aeroplane Company. (May 9, War D.)

American height flying records were broken at San Diego, Cal., on May 11, by Lieut. W. A. Robertson, U. S. A., junior military aviator at the North Island training school, who reached a height of about 16,400 feet. The American record, 16,335 feet, had been held by Victor Carlstrom, who was killed in a flight at Newport News, Va., on May 9. Lieutenant Robertson had as a passenger Lieut. C. K. Rhinehardt, U. S. A. They used a 300-horsepower battleplane. Zero temperature prevailed above the 16,000-foot level and both aviators suffered intensely from the cold.

The Southern Department has been authorized to take steps for the establishment in San Antonio of the largest field yet opened by the Government. An option has been secured on 1,000 acres of land located about six miles south of the city on the Frio Road and this will be purchased by the War Department. Major Gen. J. J. Pershing was instructed to organize two more aero squadrons in San Antonio and these, with the officers, men and machines now stationed at the aviation field east of Camp Wilson, will be transferred to the new field. The present aviation field will be turned over to the remount station at Fort Sam Houston and the hangars dismantled and removed to the new field. Many recruits for the Aviation Service are being received from the East, according to Colonel Barnum, Chief of Staff, and the officers at the present field will be divided up among the new squadrons to be formed. Further recruiting in this branch is being carried on daily and sufficient men and officers for the greater air arm of the Department are assurred.

The following officers of S. O. R. C. to active duty: Major G. M. York to station in New York, N. Y.; 1st Lieut. J. R. Whitehead to station in New York, N. Y., as assistant to the signal officer of Eastern Department; 1st Lieut. R. R. Whiteside to San Fransisco, Cal., for duty as assistant to signal officer of Western Department. (May 12, War D.)

Sick leave one month to 1st Lieut. Birdseye B. Lewis, S. O. R. C., Base Hospital No. 1, Fort Sam Houston, Texas. (April 27, S. D.)

The following officers of the Aviation Section, S. O. R. C. to active duty at Governors Island, N. Y., for duty in connection with the organization of the 1st Reserve Aero Squadron, Signal Corps; Major Raynal C. Bolling, Capt. Philip A. Carroll, Capt. James E. Miller, 1st Lieuts. Daniel R. Noyes, Frederick T. Blakeman, Charles Reed, Hobart A. H. Baker and Edwin M. Post, jr. (May 10, War D.)

First Lieut. Fred A. Post, Aviation Section, S. O. R. C., to active duty at Fort Omaha, Neb. (May 12, War D.)

First Lieut. Edward R. Kenneson, Aviation Section, S. O. R. C., to active duty at Princeton, N. J.) (May 9, War D.)

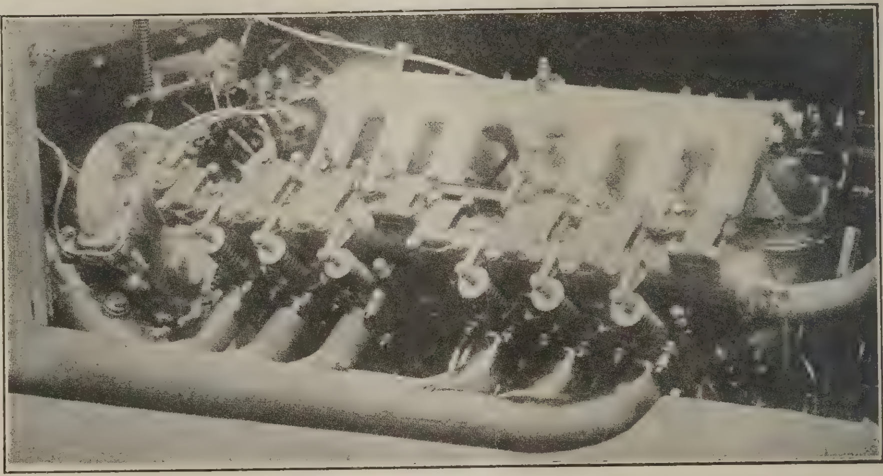
Two views of the extensive factory of the Hall-Scott Motor Co. at San Francisco, where the Hall-Scott aviation engines are manufactured

THE MECHANICAL DEVELOPMENT OF AVIATION

By NEIL MacCOULL, M. E.*

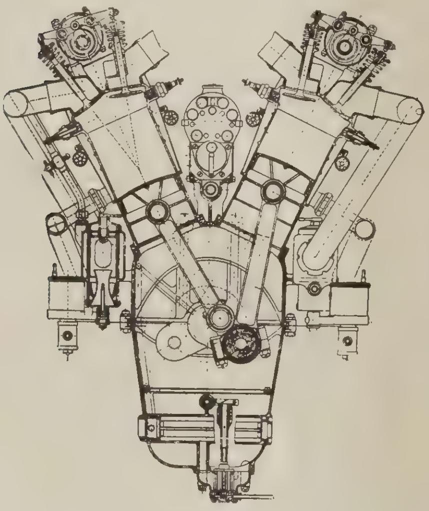
PART III

(*Continued from page* 334)


An Experimental Engine Built by the Packard Motor Car Co.

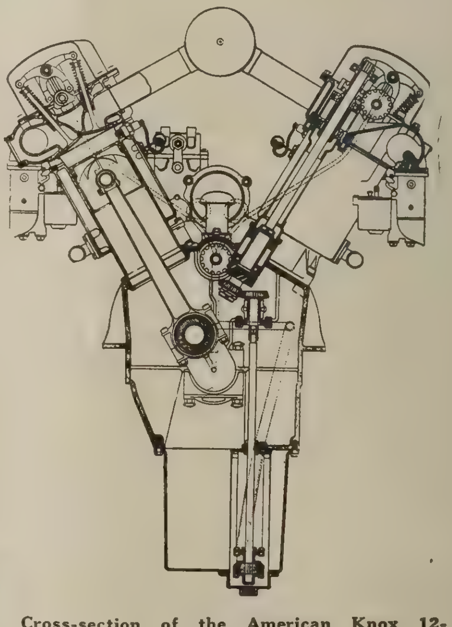
No official confirmation has been received so far of any Mercedes engine with more than six cylinders except the one shown, which was built for Zeppelins; but the modern Zeppelins do not use this type of engine. Instead they use six cylinder vertical engines of 00 H. P. at 1,200 r. p. m., the cylinders being about 6 inches in diameter with a 7½ inch stroke. The most interesting feature of these engines is the use of five valves in each cylinder head; two intake and three exhaust. One rocker arm operates each set, from a push rod operated by cam-shafts, of which there are two, located on either side of the crank case. The use of so many valves is food for much thought. It seems that exhaust valves give about as much trouble as any part of an aeroplane engine except the spark plugs, and this is due to failure by heat. Small valves are much easier to keep cool than large ones, and it may be depended upon it that German designers would not have gone to this complication if the results had not been worth it.

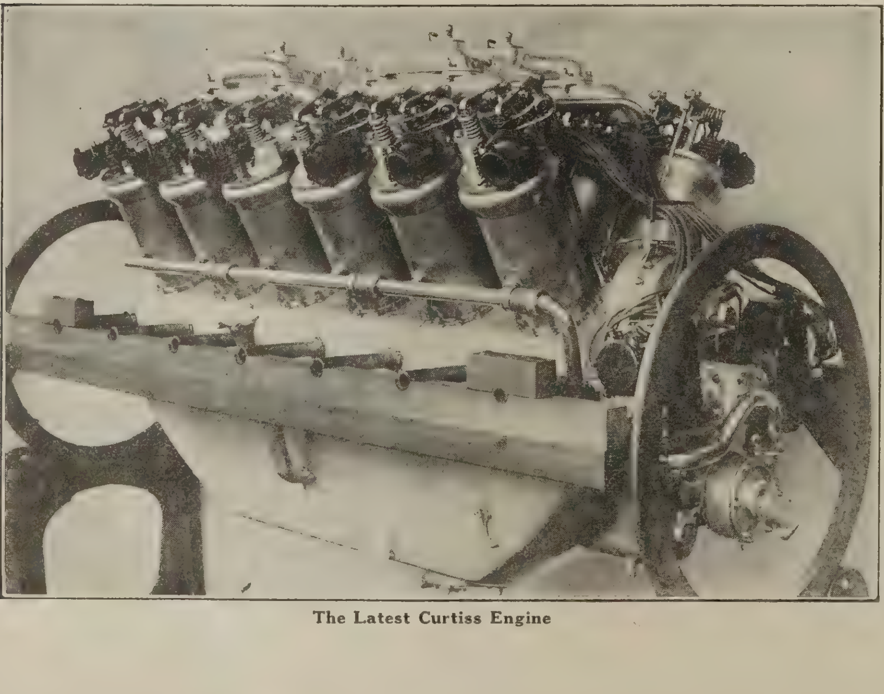
One of the first American engines to follow the lead of the Mercedes as to type was the Hall Scott. The cylinders of this engine, while individual as in the latest Mercedes, are cast with integral water jackets, giving a more rugged though heavier construction. The intake manifold and double jet carburetor are water and oil jacketed, the oil jacketing not only warming the carbutetor, but cooling the oil. The valve mechanism of this engine is very nicely worked out. It is the middle one shown on Fig 13, the one to the left being that of the Mercedes. The cam-shaft housing is cast of aluminum and may be detached as a unit from the cylinders without disturbing the valve rockers. Notice the felt washers on each side of the rockers where they pass through the housing; and the effective means taken to lock the adjusting screws on the split ends of the rockers. The tube shown in the cylinder casting between the valve passages is the water outlet, the tube passing through all cylinders with openings cut in it opposite the exhaust passages so as to secure good circulation around these hot parts. A noticeable characteristic of all valve mechanisms of this type is that the valves can be removed only by taking them out through the cylinders.


Cross-section of a 12-Cylinder Water-cooled Renault

The two points of chief interest shown in the section of the Mercedes valves, are the method of building the cylinders up by welding, and the location of the rocker fulcrum so as to give the valve 50 per cent greater lift than its cam. It is a small detail, but one which means a good deal in results.

The valve construction shown to the right is that of the Wisconsin engine, which will be described later. It will be seen to be quite similar to the other two in general design. There is a little lip on the rockers just under their fulcrums which should not be overlooked. Its purpose is to drain off the oil which would tend to leak out of the housing. The passage in the lower part of the housing acts as a return for the surplus oil fed to the cam-shaft.


Cross-section of the American Knox 12-Cylinder Engine


The Latest Curtiss Engine

Another six cylinder engine of this general type is the Christofferson. The rocker arms are of different lengths, as in the Mercedes, but the whole valve mechanism, including springs, is enclosed. This makes a very neat arrangement, and one that assures excellent lubrication of these parts, but it is doubtful if it is a wise policy to enclose the springs. It has been found very advantageous with many engines to allow the valve springs to project through the aeroplane hood so as to be sure that they will be well cooled. One of the most interesting features of this engine is the ring type of intake manifold, which allows each cylinder to draw its fuel mixture from two directions, and would appear to give equal distribution to every cylinder without resorting to two carburetors. At the bottom of the crank-case can be seen the oil radiator which is beginning to be considered so valuable lower part of the crank case when it is removed.

The experimental engine built by the Packard Motor Car Co., which is shown in Fig. 16, is worthy of attention because it has been developed under intimate knowledge of requirements at the battle front. It is a twelve

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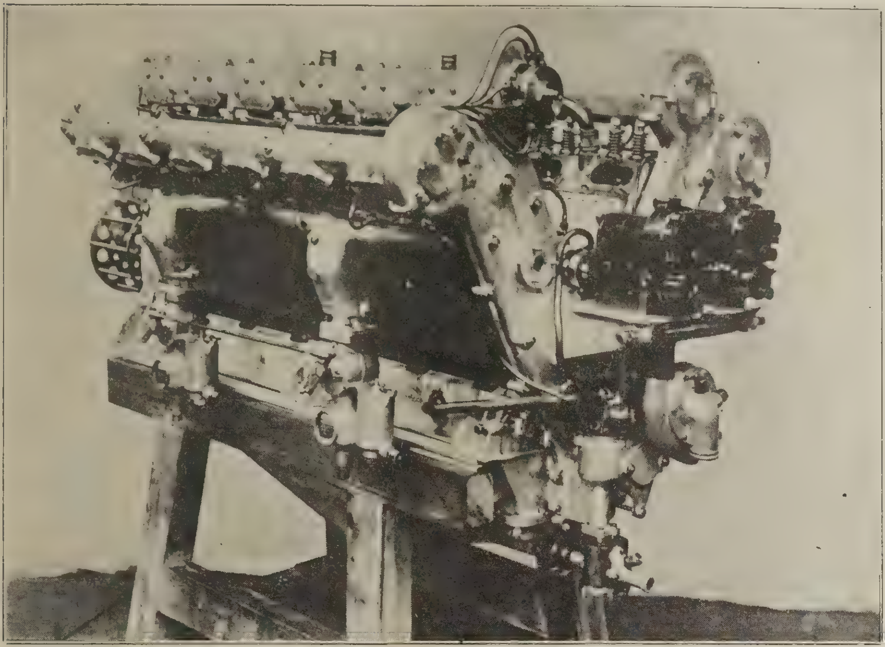
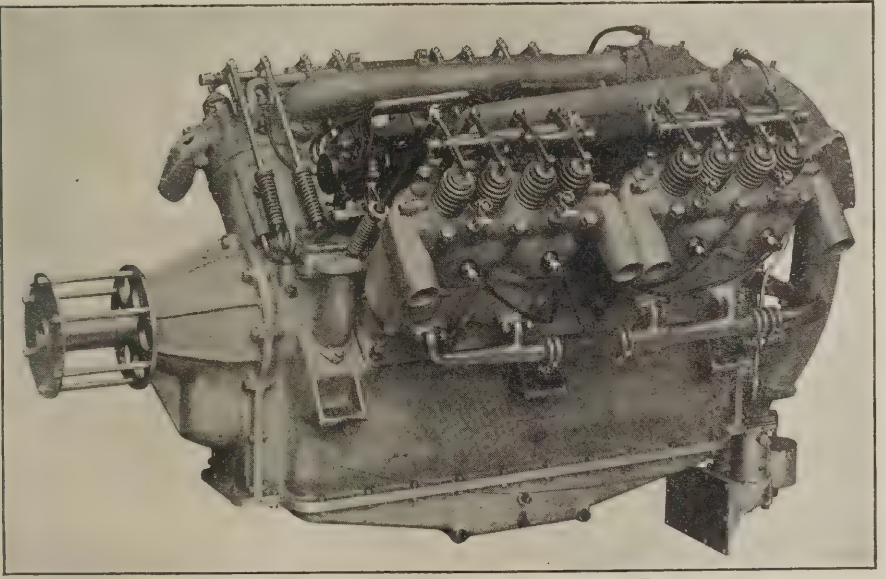
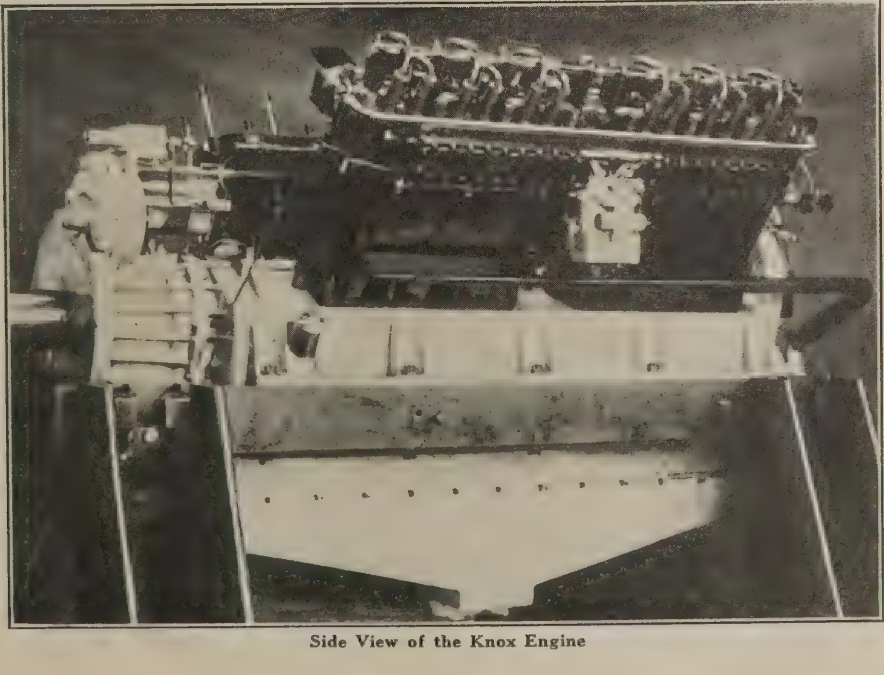
* The Westinghouse Machine Co.



A New Sunbeam Engine With Two Cam-shafts for Each Row of Cylinders



The New Sturtevant Eight-cylinder "Aluminum" Engine



Side View of the Knox Engine

cylinder V-type engine with 60° between rows of cylinders. The intake manifolds, of which there are two, are the first departure from usual practice which meets one's eye. They are designed with the idea of supplying each cylinder from a large header in which the gas velocity is so low that every cylinder has almost the same pressure drop from the carburetor which is located in the middle. One would not expect very good carburetion, however, unless the fuel is perfectly vaporized, a condition not often realized, particularly at the extreme cold of high altitudes. A very clever design has been made use of in taking the valve rockers through the cam-shaft housings. The fulcrum takes the form of a short shaft with one of the arms on each end. The bearing of this fulcrum makes a comparatively oil-tight joint. The cam-shafts are driven by trains of spur gears instead of by lay-shafts and bevel gears.

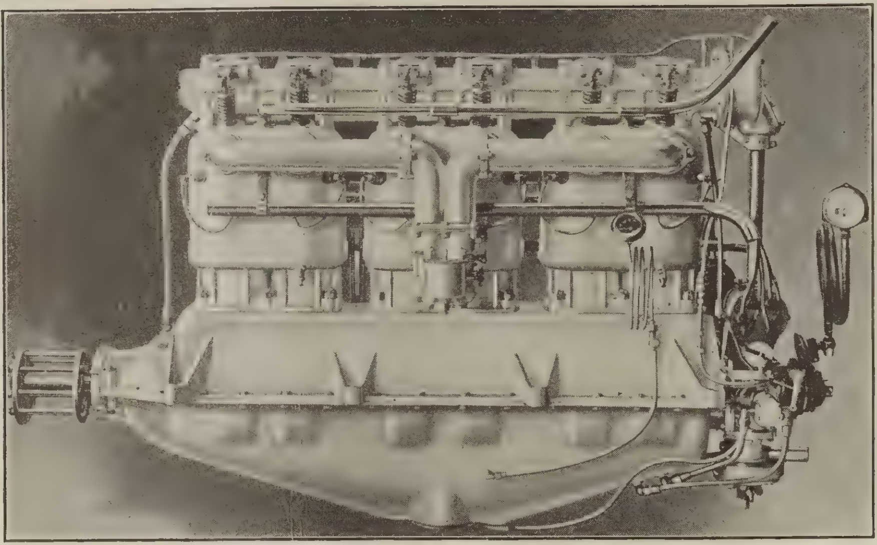
Fig. 17 shows a twelve cylinder engine which is the latest production of the Curtiss industries, and bears ear marks which are characteristically "Curtiss." In fact, the cylinders and valve mechanism are practically identical even in size with those used on the 8-cylinder 160 horsepower model. It is rated at 250 horsepower. The cylinders are made of high carbon steel drop forgings, with monel metal jackets brazed on. All valves are operated through rockers and push rods from a single cam-shaft in the crank-case, like the valve drive of the Buick automobile engine. The push rods, with the intake manifolds and their four carburetors, together with the 24 cables for double ignition certainly make an imposing collection between the rows of cylinders.

One of the well known British engines is the Sunbeam, which is shown in Fig. 18. In this design the manufacturers have finally discarded the L-head cylinders which have characterized all previous Sunbeam aeroplane engines, and have made a radical departure from usual valve mechanisms. There are four valves to each cylinder, two intake and two exhaust, and these valves are operated by two overhead cam-shafts to each row of cylinders, one shaft for the inlet valves and the other for the exhaust. The cam-shafts are driven by trains of spun gears. This type of valve mechanism has been used on Sunbeam racing automobiles for a number of years. Notice that two carburetors are used on each row of cylinders, and that a compressed air starting system is used as evidenced by the distributing valve at the end of the exhaust cam-shaft just to the left of the magnetos. The propeller is driven at a lower speed than the engine by means of gearing.

The description of the following two engines are particularly interesting because they have been brought out very recently by manufacturers who have had considerable experience in building engines for war service, and involve changes from their usual practice which have been found advantageous after trial at the front. The first is the Sturtevant. For years the B. F. Sturtevant Co. has been a strong advocate of L-head cylinders and has apparently had much success with them, but they have finally given in to the overhead type. The cylinders and heads are cast of aluminum and provided with steel liners and iron valve seats which are cast in the aluminum. The use of detachable cylinder heads is quite an innovation in the aeroplane world and shows a desire to make accessibility a stronger factor than is now customary. Like the great majority of aeroplane and automobile racing engines, aluminum pistons are used. When referring to aluminum, I mean aluminum alloy, of course, for pure aluminum is no more like its alloys than iron is like alloy steel, and in its unalloyed state would be absolutely worthless in this service. This engine is of the high speed type with geared down propeller, the engine running normally at 2,000 r. p. m.

The engine shown in Fig. 20 is the new water-cooled Renault of 220 horsepower. For years the manufacturers of this engine have supported the twelve cylinder V-type engine with forced draft air cooling. Now they have adopted water. They have also dropped the high speed feature with geared down propeller shaft, and the valve mechanism with cam-shaft in the crank-case—features which have always been characteristic of Renault aeroplane engines. The valve mechanism is now strikingly like that of the Mercedes. Use is made of two double carburetors and four six cylinder manetos. Notice particularly the connecting rod construction with one rod pinned to a boss on the rod opposite to it. This is used on no other engine except the new Wisconsin "twelve," though it must have given good results because Renault has used it for so many years.

In Fig. 20A is shown a section of a 300 horsepower engine just brought out by the Springfield Motors Co., and shows an innovation in aeroplane engine valve mechanism. Not only are the rockers unusually compact because of being bell cranks, but each arm which operates the valves is forked so as to open two valves from a single cam. There are two intake and two exhaust valves to each cylinder which feature very considerably reduces the



Carburetor Side of the Wisconsin Engine

stresses in these parts on account of lower inertia forces, and results in much greater reliability and longer life. The cylinders are cast of aluminum with cast iron liners ⅛-inch thick. The pistons are of aluminum, of course, and so are the cylinder heads, the iron valve seats being cast integral. The oil pump at the bottom of the crank-case is shown with its drive from bevel gears on the cam-shaft lay-shafts which are driven by spiral gears.

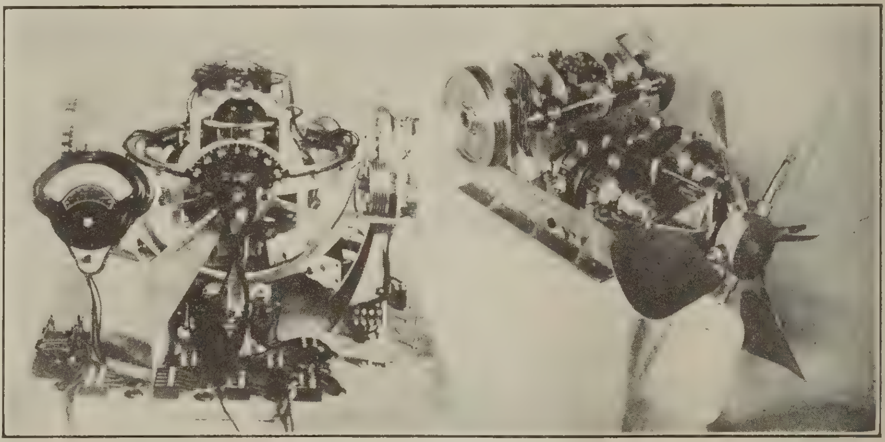
Fig. 21 shows the general appearance of the engine with the cover for the valve mechanism removed, showing the forked valve rockers. The double carburetor bolted to the cylinder castings shows how intake pipes have been eliminated by casting the manifolds integral with the cylinders, where they are water jacketed. The housing of the reduction gear for the propeller shaft is very prominent at the left, the engine being designed for 1,600 r. p. m. and the propeller 1,140 r. p. m. Since the propeller is 14 feet in diameter it can be understood why it is not run any faster than this if any one checks up the speed of the tips of the wooden blades. It amounts to more than 830 feet per second. An outstanding feature of this engine is that it is an assembly of complete units. The cylinder head with cam-shaft and all valve parts makes one complete assembly which is easily detachable without disturbing any of its parts, and the reduction gear and electric starting motor with its gears, makes another.

The Wisconsin engine has been brought out recently by the same company that manufactured the engines for the famous Stutz racing automobiles, and embodies many of their best features. It is another instance of the intimate relations existing between aeronautical and racing automobile engines. The cylinders and pistons are of aluminum, and of course the crank-case is. The cylinders have hardened steel liners 1/16 inch thick, and the iron valve seats are cast integral with the aluminum. A cross section of the valve mechanism was shown in Fig. 13 with the Mercedes and Hall Scott valves. Two magnetos and a double jet carburetor are used, of course.

The longitudinal section of the engine shows details of the lay-shaft drive for the cam-shaft. The magnetos are driven by spiral gears in this design. Nothing is contained in the lower part of the crank case except the usual oil filters. The twelve cylinder engine is made up of two sets of the cylinders and valve mechanisms of the six cylinder model, and is rated at 280 horse power. Instead of driving the cam-shaft by lay shafts and bevel gears, two trains of spur gears are used. As mentioned before, the connecting rods of one side of the engine hinge to bosses on the rods of the other side, as is characteristic of the Renault. Four six-cylinder magnetos are arranged across the front of the engine. Provision is made on most of these large engines for mechanical or electric starters, and the electric generators for searchlights and wireless sets which are often carried.

So far the development of the aeroplane power plant has been dealt with almost entirely, but engines do not begin to cover all the mechanical parts of modern aeroplanes. The time is so limited that I can merely mention a few of the other parts which this new science is developing. Mechanical starters alone make quite a study, and beside compressed air distributors and air engines include even small gasoline engines of about 4 horsepower which weigh but 23 pounds with their own magnetos and carburetors. Then there is a special gun of large bore for aeroplane use, which fires out of both ends at the same time in order to eliminate the recoil. There is a score or more of special instruments which have been devised to indicate the speed, angle of incidence, drift, altitude and other factors necessary for the navigation of an aeroplane Mechanical stabilezers also have been developed. Fig. 24 shows two of the units of the Sperry system, the one at the left being the gyro proper and the one at the right the servo motor which operates the controls. Four small gyroscopes driven by three phase current maintain a constant horizontal reference plane, and motion of the aeroplane about this plane closes electrical contacts which operate clutches in the servo-motor. The windmill of the servo-motor which is exposed to the relative motion of the air, is the source of power used in operating the controls. When the windmill reaches a predetermined speed the blades fly outward, at the same time turning so as to reduce their pitch, thus holding a constant speed. The magnetic clutches when energized connect the windmill to worm gearing, which drives the drums over which the control wires are wrapped. With this stabilizer it has been shown possible for the aviator to leave his controls and walk out on one of the wings while in full flights.

In closing it is well to call attention to the fact that progress in the mechanical engineering of aviation is so rapid at present that the designs shown in this article as the last word in the art will probably be out of date this time next year and will be merely of interest tical lay-shaft. The drive of the centrifugal as historical stepping-stones.



Two of the Units of the Sperry Aeroplane Stabilizer

The Flying Machine

The Flying Machine from an Engineering Standpoint. By F. W. Lanchester. (Constable & Co. 4*s.* 6*d.* net.)

"The author's 'James Forrest' lecture, now presented in book form, was delivered before the Institution of Civil Engineers three months prior to the outbreak of war; it constituted an attempt to epitomize the state of scientific aerodynamic knowledge, and of the technical art of aeroplane construction at that time. . . .

"The present republication of the lecture has been undertaken in order to meet the many applications for copies, which have been greatly in excess of those available. . . .

"Incidentally, the author has taken the opportunity of republishing a paper which was contributed by him to the 1915 International Engineering Congress, San Francisco, Cal. ('Concerning the Theory of Sustentation and Expenditure of Power in Flight')."

The above quotations from the preface serve to show the aim of this book, and those who are familiar with Mr. Lanchester's outlook will not need to be told that a detailed discussion of it cannot be undertaken in a short notice. Those who are not familiar with Mr. Lanchester's wide range of vision and unconventional treatment of aeronautical problems have undoubtedly missed much that is stimulating and suggestive, but not everyone will be ready to concede that because he touched on certain aspects of the matter years ago, therefore all subsequent work on those aspects is founded on the Lanchester basis. It should be said at once that no specific claim of this sort is here made; it is, however, implied in much that Mr. Lanchester has said and written. This is quite apart from the points on which Mr. Lanchester still finds little support, such, for example, as his "cyclic" theory of sustentation, which he rightly classes as still a matter of controversy. It may be that, as Mr. Lanchester clearly anticipates, this theory will form the basis of the future aerodynamical theory of sustentation. He is certain of its truth, and has certainly done his best to persuade others of the value of the revelation which came to him so long ago as 1894. That so long a period has elapsed without success attending his crusade may be interpreted how one pleases; it, at any rate, gives the present reviewer a pleasing sense of companionship in his attitude of "not proven," while not preventing him from recognizing the value of Mr. Lanchester's contributions to aeronautical science.

California Branch of S. K. F. Organized

In order to more readily supply the rapidly increasing demand for S. K. F. bearings on the Pacific Coast, the S. K. F. Ball Bearing Company of California, Inc., has been organized for the sale of these well known self-aligning radial and thrust ball bearings.

The main office of this company, under the direction of Mr. A. M. MacLaren, has been opened in San Francisco at No. 341 Larkin street, and at this office a large and assorted stock of bearings will be carried. The engineering services of the company will also be available by addressing this office. The company's engineers will be glad to investigate conditions and assist the users of ball bearings, present and prospective, in determining the best means of reducing friction losses and selecting an equipment.

MILITARY OBSERVATION BALLOONS

By Major C. DeF. CHANDLER, Signal Corps

WHEN a few short years ago the aeroplane proved to be a successful invention, and the attention of practically all students of aeronautics was drawn to its development for military purposes, interest in the captive balloon as a means of observation waned, not only in the United States, but abroad. In our case, the lack of sufficient appropriations for the aeronautical service of our army was also largely responsible for our failure to develop this valuable auxiliary.

The present war in Europe has demonstrated that the aeroplane, while of the greatest value for aerial reconnaissance, is not able to replace the captive balloon. Though it possesses the advantage of mobility and the ability to pass directly over the positions to be observed, the results of its reconnaissance must be reported by radiotelegraphy, by special codes of visual signals, or by a return to the starting point to drop written messages.

The great advantage of the captive balloon is derived from the fact that the observer is constantly in direct telephonic communication with the artillery commanders in his vicinity; constant and thorough inspection of the enemy's positions with the aid of powerful glasses and telescopes reveals every movement of bodies of troops or anything new that has appeared during the previous night, and the targets thus presented can be immediately taken under fire. Continuous and searching observation of the same sector enables an observer to note even slight changes in the color of the earth and to make important deductions therefrom. Changes in trench construction can thus be easily detected.

One observer on the western battle front in France states that he was able to count twenty-six balloons in sight at one time; this is convincing testimony of their extensive use. It is an interesting development of the present war that battle type aeroplanes are assigned for the protection of the captive balloons and for this purpose cruise about at a height of several thousand feet above the balloon ready to swoop down upon any enemy aeroplanes that attempt to destroy it.

The spherical type of captive balloon has been abandoned in favor of the kite type, often referred to as "sausage" or "drachen" (German for sausage) balloon, since the latter type has much greater steadiness in winds; the pressure of the moving air against the under side of the balloon holds it steady in the same manner as in the case of the common paper kite.

The kite balloon is fitted with a tail consisting of several conical canvas cups, to assist in maintaining its stability, with the same result as is secured by affixing a tail to the toy kite.

In Europe the observation balloons are placed about four miles in rear of the line of trenches, and are separated by intervals of approximately six miles. The altitude at which they are held is dependent upon the atmospheric conditions and upon the distance of the enemy's artillery. They are usually sent up at daylight, and remain in the air until dark, being drawn down every few hours to change observers. Occasionally they remain up at night, and it is frequently found that enemy guns that are not visible by daylight may be located at night by their flashes. Even after dark it has been found that observers who have studied every feature of the ground for days are able to see enough to fix accurately the position of the flashes. The strain of constant observation with high power glasses or telescopes makes it advisable to change the observers at frequent intervals.

It is customary to have two officers in the car of the balloon, and they are connected with the ground by telephone. One method is to have an insulated telephone wire in the center of the cable which holds the balloon; another method is to drop a strong, light-weight wire from the basket of the balloon to connect with the telephone circuits directly underneath. In both cases the steel wires of the holding cable serve to complete the electric circuit for the telephones.

Balloon companies are provided with telephone switchboards so that the observer in the basket can communicate directly with any battery or higher artillery commander in his vicinity.

Buildings, hills, or specially constructed towers concealed by trees are frequently utilized in conjunction with captive balloons to provide an auxiliary observing station, so that the two may serve as the end stations of a base line for the accurate location of targets. In some cases another balloon is used as the second observing station.

It has been learned that at the beginning of the war various special codes of signals were experimented with for the purpose of enabling observers to report the error in the fall of shots, but these have been discontinued in favor of the brief announcement of "over," "short," "right," and "left." Perhaps this simplification is largely due to the accuracy with which the prospective target is first located by means of the two observing stations on the base line.

For service with the mobile army it was customary in Europe before the war to have highly trained balloon companies, able to inflate a balloon and have it, with its observers, several thousand feet in the air in about twenty minutes after the organization had halted; this speed was attained by using compressed hydrogen carried in special vehicles. The information of three or more years ago indicated that the peace strength of the balloon companies in Europe averaged about sixty men. The arduous and continuous service that has been required during the war has necessitated an increase in the number, there being at the present time in some cases 160 officers and men assigned to one kite balloon; this number provides for three reliefs for the captive balloon, the observation tower personnel, the telephone switchboard operators, and details for the manufacture of hydrogen.

Since the service along the western battle front has been in the nature of siege warfare, it has been practicable to supply hydrogen from portable field generators, instead of furnishing it compressed in cylinders.

The average capacity of the kite balloon is 28,000 cubic feet. There is continuous loss of hydrogen due to leakage through the fabric and to losses from expansion at high altitudes; these losses are ordinarily replaced at night. A common method of replacing gas is to fill small balloons called "nurses" at the nearest field generating plant; a small detachment of men can easily conduct this supply balloon to the hangar and transfer hydrogen from the "nurse" to the captive balloon as it may be required.

The most modern type of windlass for holding captive balloons consists of a winding drum constructed on a motor truck, taking power from the truck engine.

Whenever enemy aircraft attempt to destroy a captive balloon, it is customary to haul it down rapidly or to keep it moving around the field, to lessen the chances of its being hit. The moving is often done by using twenty-five or more men, each having a rope attached to a snatch block, through which the cable is passed. These men then walk to various points in the field, and their movement changes the position of the balloon not only horizontally but vertically as well.

Captive balloons are occasionally destroyed by incendiary bullets, arrows, or bombs dropped by aviators. Destruction in this manner is not necessarily fatal to the observers, as they are usually provided with parachutes attached to safety belts, which permit their safe descent to the ground.

About eight years ago, while Fort Omaha was garrisoned by signal corps troops only, a large balloon hangar was constructed at that point, together with a plant for generating hydrogen by the electrolysis of water and the machinery for compressing the gas. After its completion, the equipment was used for about two years for free and captive balloon instruction, but its employment for this purpose was later discontinued for the reasons previously given.

The U. S. Army Balloon School is now being established at Fort Omaha, all old serviceable equipment being used and much new material of every kind being added. It will not be long before the first balloon company will have everything that is needed, of the most modern type, including specially designed motor trucks for carrying compressed hydrogen.

In addition to organizing and equipping balloon companies for service with the mobile army, the school will probably be called upon to train officers and men in the handling of captive balloons at coast fortifications.

In case the cable holding a captive balloon should break, it then becomes necessary for the observer to descend and land in the same manner as in manœuvring the ordinary free balloon, for which reason an essential part of the preliminary training of students at the Balloon School will consist of the navigation of free balloons and qualifying as pilots thereof.

A tentative plan for the organization and equipment of balloon companies and battalions has been prepared, which will be tried practically at Fort Omaha before action is taken with a view to its official adoption. In order to reduce the impedimenta of balloon companies without impairment of their mobility, it is probable that field hydrogen generators and compressors will be carried only by one supply company in each balloon battalion.

There are several types of hydrogen generators suitable for field service, all of which should be thoroughly tried before the adoption of any one type or method. There is need also of larger types of generators and compressing machinery installed in railroad cars, which may be placed at the nearest rail points to the balloon companies as a refilling station for hydrogen cylinders.

Observation balloons are necessary for both field and coast artillery, but the mobile balloon companies are principally for the service of the field artillery. In Europe the observers are almost without exception field artillery officers, and it is natural that such should be the case in view of their training and experience in the location of targets and the observation of fire. It is therefore hoped that the field artillery officers of our army will become interested in this new auxiliary to their arm of the service.

In time of peace, details to the Balloon School, like those to the Aviation Schools, are made only upon the application of the officers through military channels. A physical examination, similar to that prescribed for applicants for aviation duty, is required. The student officers for the Balloon School are not, however, limited as to age and grade. Some field officers will be needed for administrative duties with the balloon division of the Aviation Section, and in order to be fully qualified for such positions they should be graduates of the Balloon School.

THE COURSE OF TRAINING AT THE U. S. ARMY BALLOON SCHOOL

The course of training at the Army Balloon School, at Fort Omaha, in which Major Chandler is in charge, is both practical and theoretical, and so arranged that the practical instruction has preference at all times when weather conditions are suitable.

Whenever high winds or rain interfere with the outdoor training the classroom instruction is held and consists principally of conferences. The instructor covers the subject thoroughly and students are expected to ask questions and join freely in discussion. Practical instruction in the measurement of specific gravity of gases, testing and adjustment of instruments and similar laboratory indoor work is conducted when weather conditions outside are unfavorable.

A number of officers of the Regular Army and Reserve Corps are undergoing practical training, and the school is also designing and trying out new types of field equipment of all kinds. Leo Stevens is in charge of the practical instruction of pilots and Major Hersey is instructor for the theoretical and classroom work, meteorology, etc. Upon completion of the course the students will at once be assigned with organized balloon companies for the mobile army, and for the installation and operation of observation balloons at coast defenses.

An outline of the course follows:

Practical Instruction

Generation and compression of hydrogen.

Hydraulic testing of gas cylinders.

Spreading envelopes and assembling parts of free and captive balloons.

Inflation of balloons.

Balancing free balloons.

Use of ballast and balloon instruments while on voyages.

Selection of landing spots and drag-roping.

Deflation by valve and rip panel.

Folding, packing and shipment of balloons.

Replacing of rip panel, repairs and inspection of envelope and net.

Qualification as balloon pilot according to F. A. I. Rules.

Testing of cordage and fabric for breaking strength.

Testing of fabric for permeability to gases.

Practical handling of captive balloon windlass.

Filling kite balloons rapidly from cylinders of compressed hydrogen.

Motor truck operation and maintenance.

Determining course and position of free balloon by use of maps and compass.

Conferences: Organization, Equipment and Training

Assignment of duties, commissioned and enlisted personnel.
Transportation and special technical vehicles.
Replacing gas lost by diffusion and expansion.
Repalcement of empty hydrogen cylinders.
Field hydrogen generators.
Field compressing outfits.
Methods of observing and indicating targets and plotting shots.
Telephone service from balloons, instruments and circuits.
Photography and sketching from balloons.
Visual signal codes from balloons.
Property damage caused by descent in free balloons.

Conferences; Balloon Construction

Kinds of fabric suitable for balloons.
Preparation and application of varnishes for cotton balloons.
Cordage for nets and suspenders.
Shapes of balloon envelopes and standard sizes.
Strip and panel construction for envelopes.
Laying out patterns for envelopes.
Various types of seams.
Designs and tests of suspension patches.
Manufacture of nets.
Types and sizes of maneouvering valves and pressure valves.
Size, location, cord attachment and replacement of rip panel.
Appendix ring, neck and cord.
Kite balloon steering bags and substitutes.
Number, size and shape of tail cups.
Strength, weight, flexibility and construction of cable for captive balloons.
Sizes, types, weight and attachment of balloon cars.
Essential features of concentrating rings.

Conferences: Gases

Kinds of gas suitable for free, captive and dirigible balloons.
Specific gravity of gases and methods of determining.
Manufacture of coal-gas and water-gas.
Production of hydrogen by electrolysis of water.
Hydorgen by steam and iron method.
Hydrogen by compression and refrigeration method.
Hydrogen by decarburation of oils.
Hydrogen by silicon-soda process.
Hydrogen from hydrogenite and hydrolythe.
Testing hydrogen for purity.
Compression of gases.
Flow of gases through pipes and orifices.
Types of gas-holders and their maintenance.

Conferences: Meteorology

Indicating and recording, barometers, thermometers, hygrometers and anemometers.
Tests, maintenance and method of mounting instruments.
Various changes in atmosphere with increasing altitude.
Movement of high and low pressure areas; direction and rate at various seasons.
Movement of atmosphere over large areas.
Local effect of vertical currents.
Cloud formations and deductions from them.
Weather maps; weather predictions, storm warnings and weather signal codes.
Tornadoes and cyclones; seasons and localities.
Average wind velocity in sections of the United States.

Conferences: Dirigible Balloons

General types of rigid, semi-rigid and non-rigid balloons, and employment of each type.
Rigid dirigibles: Dimensions, shapes and materials used.
Semi-rigid: Dimensions, shape, materials, importante structural feaures and methods of car suspension.
Non-rigid: Dimensions and shapes; maintaining shape; material for envelopes; methods of car suspension.
Air resistance to various shapes and skin resistance.
Size and arrangement of ballonets.
Employment of ballast.
Vertical and horizontal stabilizing fins.
Rudders for altitude and direction.
Number and arrangement of propellers.
Gasoline engines suitable for dirigibles.
Number and distribution and sizes of motors.
Gas engine principles and maintenance.
Dynamic reaction of atmosphere on under surface.
Velocity with respect to wind direction and earth.
Navigating instruments.
Hangars and methods of entry and exit in wind.
Designs for descending on water or land.
Bomb dropping devices—Armament.

D'ORCY'S AIRSHIP MANUAL

(Excerpts from the forthcoming "D'Orcy's Airship Manual," published by the Century Co., obtainable through the Aeronautic Library, 280 Madison Avenue)

(*Continued from page* 261)

GERMANY

Rheinisch-Westfaelische Motorluftschiff Gesellschaft, Elberfeld — Builders, to the designs of Herr Oscar Erbsloeh, of a car-girder pressure airship. Trim controlled by lifting planes and trimming tanks.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**Leichlingen** (October, 1909)	53.2	10	2,900	125	50	Excursion airship.—One Benz engine; one tractor screw. Ballonet: 450 mc. Designed endurance: 6 hrs.
1a	(1910)			3,200	125	50	Was re-built and enlarged. Ballonet: 580 mc. Exploded in mid-air on July 13th, 1910, killing the crew of five including Herr Erbsloeh.

Schuette-Lanz (Luftschiffbau), Rheinau, near Mannheim—Builders of structure airships. Hull-frame of laminated wood girders, spirally wound and held under tension by wire-stays. Fabric skin. Suspended cars. Trim controlled by lifting planes.

Works No.	Name Trials	Length (m)	Beam (m)	Volume (mc)	Power (h.p.)	Speed (km)	Notes
1	**S. L. I.** (October, 1911)	131	18.4	19,500	540	71	Prussian Army airship.—11 compartments. Two Mercédès engines, mounted on two cars; each driving one pusher-screw. Best endurance: 16½ hrs. Was destroyed by a storm while moored in the open near Schneidemuehl, on July 17th, 1913.
2	**S. L. II.** (April, 1914)	144	18.4	23,000	800	87	Prussian Army airship.—Four Maybach engines, mounted on four crosswise hung cars, each driving one pusher screw. One rigidly connected pilot-car near the bow. Best endurance: 1,400 km. in 20 hrs.; altitude: 2,100 m. Performed during the early part of the Great War on the Russian front until she was, in November, 1914, badly punished by Russian gunners and appears to have subsequently been dismantled.

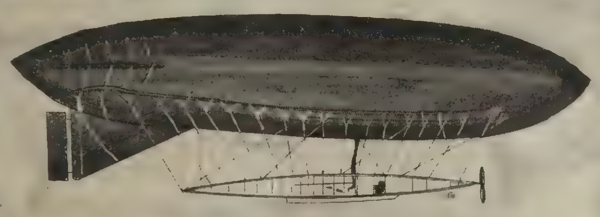
Schuette-Lanz (Luftschiffbau), Rheinau. (Continued)

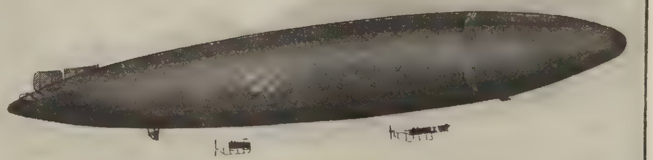
3	**L. 4** (1914)	**165**	**18.4**	**30,000**	**1,080**	**90**	German naval airship.—Four Mercédès engines driving four pusher-screws as on *S.L.II.* Was "iron-crossed" for her co-operation in the sinking of H. M. ships *Aboukir, Cressy* and *Hogue,* on Sept. 22nd, 1914, by the submarine *U.9.* Stranded in a storm, on Feb. 17th, 1915, near Esbjerg; all of the crew saved themselves but four who perished when the airship was carried away by the storm.
4	**S. L. III.** (January, 1915)	**144**	**18.4**	**23,000**	**800**	**87**	Prussian Army airship.—*S.L.II.* type.
5	**L. 7** (February, 1915)	**165**	**18.4**	**30,000**	**1,080**	**90**	German naval airship.—Same features as *L.4.* Was shot down on May 4th, 1916, off the Schleswig coast, by H. M. ships *Galatea* and *Phaëton;* seven of her crew were made prisoners.
?	**L. 21** (1915)	**165**	**18.4**	**30,000**	**1,080**	**90**	German naval airship.—Was set on fire and destroyed with all on board on Sept. 3rd, 1916, near Cuffley, by Lieut. William L. Robinson, V.C., R.F.C.

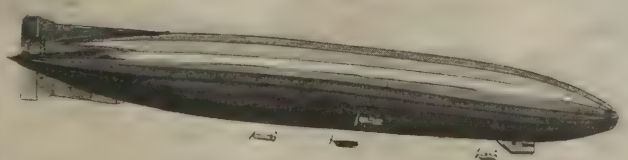
Schwarz (David), Berlin—Builder of the first structure airships. Hull-frame of aluminum tubing; skin of 0.2 mm. aluminum sheeting. No compartments. Trim controlled by a lifting screw. No elevator, nor rudder.

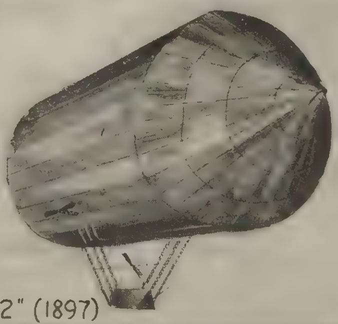
Works No.	**Name** Trials	**Length** (m)	**Beam** (m)	**Volume** (mc)	**Power** (h.p.)	**Speed** (km)	**Notes**
1	**No. 1**			**5,000**	**12**		Built in Petrograd. Burst during her inflation in 1893 through the breaking of the inner wire-stays. One Daimler engine; twin-screws.
2	**No. 2** (November, 1897)	**47.5**	**14**	**3,700**	**12**	**18**	Built in Berlin.—Hull of elliptical cross-section. One Daimler engine; twin-screws and one steering screw. On her trials the airship was unable to make any headway against a wind of 7.5 m/sec. and was damaged on landing. After having been emptied the airship was completely destroyed by the wind and the vandalism of the spectators.

GERMANY


R.W.M.G - "Leichlingen" (1909)


Schuette-Lanz - "S.L.I" (1911)


Schuette-Lanz - "S.L.II" (1914)


Schwarz - "N.º2" (1897)

FOREIGN NEWS

FRANCE

Amsterdam, May 17.—The Telegraaf quotes a statement printed in a German newspaper that the noted French airman, Captain René Doumer, son of Paul Doumer, former President of the French Chamber of Deputies, who is reported missing, was shot down behind the German lines and killed.

Captain Doumer was credited in the French War Office report of March 19 with having brought down his sixth enemy machine.

Paris, May 16.—While scattering President Wilson's address to Congress inside the German lines between Laon and St. Quentin, April 13, the wings of William Dugan's aeroplane were riddled with Krupp anti-aircraft gun shrapnel from a battery 12,000 feet below. Dugan escaped unharmed, and with Edwin Parsons of Holyoke, Mass., Kenneth Marr of San Francisco distributed several thousand of the leaflets.

Paris, May 14.—This was American Day at the largest aviation school in France. Ambassador Sharp was the guest of honor during a review of the troops and an inspection of the establishment. The elaborate programme of the day culminated tonight with brilliant evolutions by a great squadron of aeroplanes.

Ambassador Sharp was accompanied by representatives of the Ministries of War, Aviation and Foreign Affairs. The Lafayette Squadron, which is composed mainly of Americans, has its home at the school and American recruits are now receiving instruction there as pilots and preparing for service at the front.

The reviewing stand was decorated with French and American flags. Soldiers cheered and filed past the stand before the Ambassador.

Later Mr. Sharp visited the quarters of the American aviators. He expressed high appreciation of the admirable facilities of the camp, which is turning out a considerable number of American pilots.

GERMANY

It might be well, some time, to forget about the practical side of aviation, and the results accomplished, and look at the romance of it all. There has recently come to hand a letter, written by a German airman, describing his last flight,—the flight in which he was mortally injured.

The letter was written by Prince Friedrich Karl of Prussia to his father, from a hospital behind the Allied lines. It follows:

"Now something about my air flight. You know I started with Walze's squadron. We cruised along the front a long time without seeing anything. We went as far north as Arras and south in the direction of Bapaume and Peronne and flew very low. On our return to the boundary we all of a sudden discovered some 900 or 1,000 meters below six or eight Vickers monoplanes. Our leader immediately went for them and I followed, not willing to leave him alone, the enemy numbering so many more machines. That our other fliers did not follow can only be explained by assuming that they did not discover the enemy in the low darkly clouds.

"How we went for them! I sometimes lost sight of the German leading machine, but always managed to find it again. Suddenly one enemy flier came my way and I attacked him. He fled. I after him. Thus I lost my only comrade.

"The enemy fliers around me increased still more in numbers. They must have noticed the dangerous condition of the men I was chasing. Meanwhile I had succeeded in manoeuvring my opponent pretty close to earth, when all of a sudden I heard the tack, tack of a machine gun behind me, and the next moment my motor stopped. The enemy behind me kept tack-tacking, with the result that soon I was wounded in the right foot. Thank Heaven, the steering levers remained intact.

"Gliding over badly battered villages and trenches, I succeeded in landing, as the Australians who captured me said afterwards, not far from the German lines. I should have liked to destroy the machine, but the enemy gunfire prevented it. My second thought was to reach our lines, but the enemy at once directed his fire at me. Still I seemed to have luck until finally a bullet pierced my spine and came out at the right of my stomach. I went down like a log.

"When finally the Australians found me, they treated me very tenderly. I had lost so much blood and was freezing with cold. Two soldiers kindly offered their great-coats and covered me with them. They carried me an endless stretch until we found a physician, but they were very careful about it."

May 19.—Destruction of the Zeppelin L-22, reported without details in an official British announcement on May 14, occurred off Esbjerg, within sight of the Danish coast, according to the accounts of eyewitnesses from villages on the shore.

These accounts indicate that not one but two Zeppelins were destroyed on that day, inasmuch as the explosion of an airship off Terschelling was reported from Holland, at a point too distant to cover the same case. The loss of the second airship is attributed to lightning.

GREAT BRITAIN

London, May 14.—British naval forces destroyed Zeppelin L-22 in the North Sea this morning, according to an official statement issued by the Admiralty. A dispatch from the east coast says news was received early this morning that the L-22 was approaching the coast. A squadron of naval aircraft went in pursuit. The Zeppelin was attacked by a battle plane which overhauled it and was seen to burst into flames.

Two members of the airship's crew jumped into the sea, *The Star* says, and the others disappeared with the burning Zeppelin.

A Zeppelin with three gondolas, enveloped in heavy smoke, was sighted today at Terschelling, Holland (an island in the North Sea), a Reuter dispatch from Harlingen, Holland, reports. When the smoke disappeared fifteen minutes later the Zeppelin was no longer to be seen.

The destruction of the L-22 marks the fourth attempt at Zeppelin raids within the last year which has ended in disaster. Two of the mammoth airships were shot down during a raid on London on September 23, 1916, and two months later two more Zeppelins were destroyed off the English coast. On March 17 French artillerymen shot down a Zeppelin behind the French lines while it was endeavoring to reach Paris.

JAPAN

The following items are taken from the *Japan Times* of March 24:

Lieutenant-General Nagaoka, retired, who is widely known as the "father of Japan's local aviation," is reported likely to announce his candidacy for the House of Representatives in the coming general election in April. If the report be true, he will contest Yamaguchi prefecture, and his candidature will in all probability be welcomed by constituents.

Miss Katherine Stinson, the American aviatress, who is now staying in Peking where she made a flight exhibition some time ago, intends to revisit this country very shortly. The lady aviator has sent the following letter to Mr. Kushibiki, who was the manager of her flight exhibition some time ago at Aoyama.

Peking, March 18.

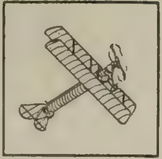
Gentlemen—I flew here yesterday and to-day, having nice crowds. The people here have been lovely, all seemed so much interested. To-day President Li presented me with a lovely cup and I am making a night flight at his request for the people. Another cup was presented to me by the Minister of the Interior. I will be honored by the presentation of cups by the Director of Aviation, Yang Yaheng and by Shanghai. The army aviators have been helping me every day with their mechanics who have been of great assistance just as were the army and naval fliers in Japan. I can hardly wait to see my medal from the Mayor of Tokyo.

I was so sorry to hear of the accident and death of Lieutenant Sawada. I sent to the War Department a telegram and received a funeral notice. Japan has deepest sympathy in his loss.

I am impatiently looking to the day when I return to Japan when she dresses up beautifully with cherry blossoms. Best regards to the aviation press men in Japan.

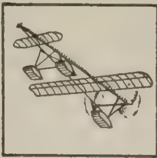
Yours faithfully,
Miss Katherine Stinson.

French Aviation Repair Truck used at the front



MODEL NEWS

Edited by G. A. Cavanagh



The "Paper Tube" Scale Model Airplane

Earle H. Bean

President, Harvard Aeronautical Society

The value of the paper tube scale model over the "flying stick" type as an instructor cannot be disputed. For myself, I learned as much about flying a big airplane with these models as I did my first month at one of the best flying schools in this country. While in the full sized machine it seemed as if I was flying in one of my models, suddenly grown big enough to carry me. The correct positions on getaways, spirals, and glides had been taught me already by these flying scale models, and hence it was easy to put the big machine in those very positions. The accidental position of the control wheel or the rudder bar does not matter, for the position of the machine in the air is of first and last importance.

The use of a paper tube for housing the rubber motor of a miniature flying machine is one of unrealized possibilities. Monoplanes, biplanes, triplanes and seaplanes of any tractor and of most pusher types can be built to a scale of about one inch to a foot. In actual flight the performances of these three or four ounce models is unbelievably like their big prototypes. The degree of refinement and approximation to the dimensions of the full sized aeroplanes being copied depends mostly on the skill of the model maker and very few compromises are necessary to achieve a realistic as well as a workable result. Any youngster with a previous experience in making rubber driven models of the "flying stick" type will be astonished at the success of his first paper tube model. For the grown-up who wishes to experiment with new types of flying machines here is an undeveloped field for preliminary tests. Let me explain how the simplest type of paper tube model is constructed.

The fuselage of the monoplane model here shown is made from a sheet of medium weight brown wrapping paper cut about fifteen by twenty-four inches and rolled and glued in the form of a long conical tube, and then shellaced for stiffness. After the glue had dried both ends of the tube were cut perpendicular to its axis and each reinforced with thin cardboard to prevent splitting out by the pull of the rubber motor or by blows suffered in flying.

The motor consists of six strands of one-eighth inch square rubber thread, or about six feet in all. That any model airplane, especially a scale model, should fly with so little power is remarkable. The rear end of the rubber motor is held by a "W" shaped wire hook, which slides into half-inch slots cut in the tube. The propeller end of the motor is attached to the shaft, which is bent like a fish-hook. This shaft passes through a corkstopper, which should fit in the tube so that half its length is outside and can be trimmed into a bullet-shaped nose. If the flat sided body of many standard aeroplanes is desired, it can be made of thin cardboard fitted around the circular tube fuselage. The propeller bearing consists of two brass washers. The shaft should be made of heavy bicycle spoke, looped at the front end for winding the motor with a hand drill or some other geared winder. If the rubber is lubricated with glycerine about four hundred turns can be obtained with a winder and about two hundred and fifty when cranking the propeller by hand. The best method of determining the capacity of the motor is the test to the breaking point, counting the number of turns. When winding the rubber with a mechanical winder, the motor should be pulled out to twice its normal length in order to get more turns.

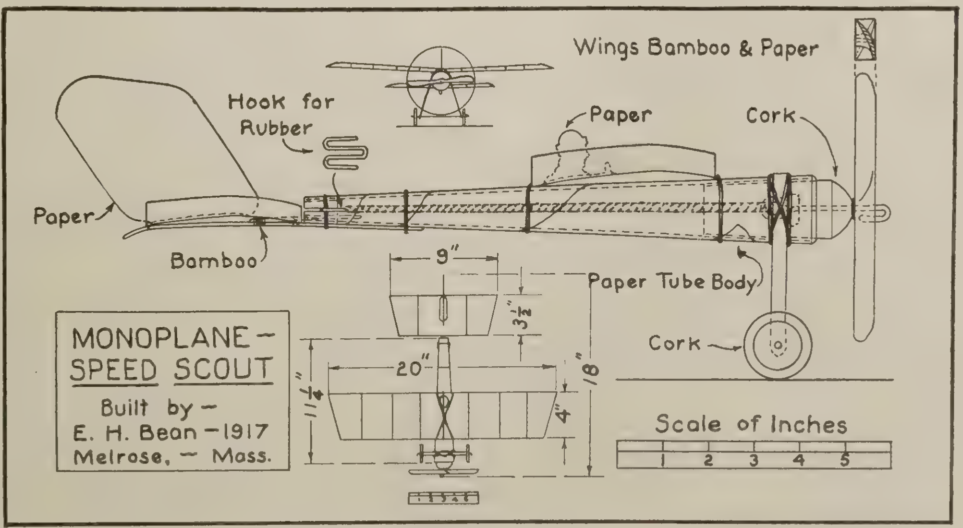
The propeller, which in this case is six inches in diameter, is of small pitch and thick blade to withstand the knocks of a tractor model. Pine propellers heavily shellaced and topped with bamboo fibre paper or china silk, will be found quite serviceable.

For the wings any light construction will do. A bamboo frame, with curved ribs and single surfaced with paper or silk, shellaced, is the easiest to make. A carefully made double-surfaced wing gives greater stability in flight. The rear wing, or elevator, is a lifting surface in this case in order that the main plane may not have to be placed disproportionally far from the propeller. A slightly less angle of incidence than that of the main plane is necessary for longitudinal balance. The rudder is made of stiff paper folded double and glued to the rear wing. Both wings have a slight dihedral. The rear wing is fastened to a strip of bamboo, which also acts as a rear skid. Another strip is tied to the first and slips inside the tube, the two pinching the tube like a clothes pin.

The landing gear is bamboo bent "U" shaped to fit the curve of the tube. A uniform curve can be made by holding the bamboo against a lighted electric light bulb, which is warm enough to bend the bamboo. Cork wheels, with brass tube hubs, and a wire axle complete the landing gear. The main plane, the bamboo strip holding the rear wing, and the landing gear are tied to the paper tube body with rubber, which allows the model to be taken apart quickly, to withstand shocks, and to be easily adjusted for balance. The complete model takes up so little room that it is advisable to glue as well as tie all but the main wing, thus making wing alignment easier.

Now let us test the model for balance. If properly adjusted it glides over a hundred feet when given a slight push from a height of six feet. After a series of test glides, wind up the motor the full amount and see that the wings are in line with each other and the axle of the landing gear.

(To be continued)



Broadway Model Aero Club

Bulletin Five V

Flying model aeroplanes is a science, to master which, requires knowledge of the fundamental laws of aerodynamics and general aeroplane construction, besides considerable practice. Two models apparently alike in every respect, say two feet long, with two propellers of the same size and the same length of rubber which when twisted supplies the motive power for the propellers, will behave quite differently when launched in the air. One may go 3,000 feet and as straight as an arrow; the other may go only a hundred feet and make a circle. The difference may be due to a number of causes, including the shape and tilt of the wings, the misplacing of the center of gravity, the pitch and size of the propellers, etc.

CASH PRIZES IN GOLD COIN will be given to the WINNERS OF EVENTS in the MODEL AEROPLANE CONTESTS to be held in Baltimore, Md.

ANY YOUNG MAN IN THE STATE OF MARYLAND IS ELIGIBLE TO COMPETE. NO ENTRANCE FEE OR CHARGE OF ANY KIND. JUST BUILD A MODEL AEROPLANE AND FLY IT. For information write to W. H. LOGUE, JR., DIRECTOR, MODEL AEROPLANE CONTESTS, 931 North Broadway, Baltimore, Md.

The Cooperation of the Aeronautic Manufactu Their Patriotic Duty and Make a Good Invest Loan Bonds on t

"Every man and woman who buys a Liberty bond will contribut conclusion. No one can doubt the outcome of the conflict if the Ameri sources of the nation."—William

To Aeronautic Manufacturers:

THE UNITED STATES GOVERNMENT $2,000,000,000 LIBERTY LOAN BONDS afford an opportunity to every man and woman to discharge their patriotic duty, and at the same time, make a good investment.

AERONAUTIC MANUFACTURERS can help their employees to do their duty and make a good investment by arranging to enable their employees to order their LIBERTY LOAN BONDS through the Company's cashier next pay day by making the first payment of two per cent of the cost of the bond and four payments thereafter.

The fact that the LIBERTY LOAN BONDS, which are authorized by Congress, are backed by the entire wealth and resources of the United States and will pay an interest of 3½ per cent per annum makes them the best and safest investment in the world today.

LIBERTY LOAN BONDS are issued in the following denominations:

Coupon Bonds: $50, $100, $500, $1,000.

Registered Bonds: $100, $500, $1,000, $5,000 $10,000, $50,000, $100,000.

The subscription books will close on June 15, 1917, and those who have failed to buy will have lost their opportunity to be patriotic and make a good investment at the same time.

The easy instalment plan arranged especially for the convenience of people of limited means enables employes of aeronautic manufacturers—no matter how small their salaries may be—to purchase LIBERTY BONDS on the instalment plan, as follows:

2% on application;
18% on June 28;
20% on July 30;
30% on August 15, 1917;
30% on August 30, 1917.

The Bonds will be delivered about July 1, 1917, or on completion of payments.

The LIBERTY BONDS are as good as **gold.** They can be sold at any time, through any bank, at the current market price, which, owing to the unusually high rate of interest for Government bonds, promises to be at a premium.

If before the termination of the war bonds are issued bearing a higher rate of interest, the holders of the bonds now to be issued may convert them into bonds bearing such higher rate, such bonds to be identical as to maturity of principal and interest and terms of redemption with these bonds, but otherwise substantially identical with the bonds of the new issue. See blank opposite page.

is Invited to Help Their Employees to Discharge
t, by Buying United States Government Liberty
Easy Terms Plan

e most immediate and directly helpful way to bring the war to a quick
eople awake to the gravity of the situation and organize the mighty re-
cAdoo, Secretary U. S. Treasury.

TREASURY DEPARTMENT,
1917 LIBERTY LOAN—**Form No. 1**
LOANS AND CURRENCY

LIBERTY LOAN

APPLICATION FOR BONDS

This application should be transmitted through the subscriber's bank, trust company, or other agency acting on his behalf, or it may be filed direct with the Federal Reserve Bank of his district or the Treasury Department at Washington.

Dated ....

To the Secretary of the Treasury:

According to the terms of Treasury Department Circular No. 78, dated May 14, 1917, the undersigned hereby apply for $................par value of the 15-30 Year 3½ Per Cent Gold Bonds of the United States, and agree to pay par and accrued interest for any bonds allotted on this application. The sum of $.............. is inclosed, being 2 per cent on the amount of bonds applied for (or payment in full for the one $50 or the one $100 bond applied for).

Signature of subscriber, in full..
Address—Number and street..
City or town..
County ....State ....

Note.—It is desirable that the following information be furnished by the applicant:

1. If full payment is to be made before final instalment date indicated in the circular, what will be the date of such full payment?..

2. If it is expected that future payments will be made by check, upon what bank or trust company will such checks probably be drawn?

Name of bank or trust company..
Address ....

3. What, if any, particular denominations of interim certificates are desired?........................

4. Through what, if any, bank or other agency is this application transmitted?........................
....

A39629

This space has been donated

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

The Flight of the Cuspidor

It was the good ship "Cuspidor,"
That sailed the azure blue.
Its captain was a brave bold man
To start with such a crew.

For one was deaf, and one was blind,
The rest, they could not see;
The first mate wore a pair of pumps,
Because he'd water on the knee.

The engine was a vee type eight
Of ninety-two h.p.,
(It's actual power when in flight
Was only twenty-three).

It was twelve when they turned her over,
At two they turned her back.
At three they gave the whole thing up
And went home in a hack.

For the engine wasn't working,
The ailerons were bent;
And gasoline they could not buy
Their money they had spent.

And though we may arouse your wrath;
In fact your indignation,
We must confess, the whole darn flight
Was pure imagination!

Our Own Puzzles, Conundrums and Jokes

Would you say that a famous swordsman was one with "Dual Control?" (Don't give it up—it's tricky.)

Reggie.—I see all the saloons are using Dep. Control.
Charlie.—Where do you get that stuff?
Reggie.—Well, hasn't each saloon a foot-bar?
(The verdict was "Killed in self-defense.")

Patriotic Recruiting Officer.—And when the bullets are flying right and left, the enemy is coming at us with cold steel, why, gentlemen, *why* should we be willing to give up our lives for our glorious country!

Voice from the back.—That's what I say, Captain, *why* should we?

Recruiting Officer, talking to possible recruit.—And if you are injured serving your country, we will look after you well. If you lose a finger of one hand, you get five hundred dollars; a foot lost, and you get one thousand, a leg——

Possible recruit.—That's far enough, captain. What you ought to get in the army is a lot of beetles!

War Notes

Petrograd.—Nicholas Romanoff, formerly known as Czar of all the Russias, is now busily engaged in shoveling snow. He is not willing to express an opinion on anything, for he is feeling quite put out.

Sap Center, Ky.—All the hands at the largest farm in this town are engaged in building an aeroplane, which they intend to fly, as soon as it is completed. Five new doctors have recently moved into town.

Hickville, N. C.—The Hickville Aeroplane School has been moved to Sap Center, Ky. Five prosperous M. D.'s moved with it.

Lambfry, Mo.—Gus Whoozis last week broke the world's record for altitude. His elevator got stuck and all he could do was point up.

Bulrush, Ia.—Seth Perkins, the county joker, last week pulled a good one on the boys. He said that Bulrush ought to be the home of the dirigibles, because there was more hot air passed around in Bulrush than in any other town in the county. "Pretty good, Seth," say we.

A Head Start

Captain.—Now boys, fight like the devil, and when your ammunition gives out run for your lives. As I am a little lame I'll start now.

A Long Search

A good story is told of an Irish Regiment, now at the front in Europe. It seems that one day one of the Irish soldiers came back with a splendid pair of Turkish boots on his feet. His friend Pat approached him.

"Say Mike," says Pat, "where did you git thim boots?"

"Took them away from a Turkish officer," says Mike.

The next day Pat disappeared. As each day passed his friend gave up hope of ever seeing him again, and at last had him posted as missing. However, one day, two weeks later Pat came staggering into camp with a splendid pair of Turkish boots on his feet; boots which far outshone the boots Mike was wearing. Pat came up to Mike, took the boots off and handed them to him.

"Mike," he said, "look at them boots. I got them at last, but I had to kill nineteen Turks to get a pair to fit me!"

Technical Queries Answered

K. L. A.—Aeroplane wings *stagger* when they are overloaded.

P. O. S.—Sorry, but we can buy no inventions this week.

U. A. X.—Your former position as a flagman on a railroad would not fit you for a commission in the Signal Corps of the Army.

L. A. W.—You are the eighth correspondent this week who has invented a machine for doing away with submarines.

O. R. D.—Your box of cigars very gratefully received. By all means write us again.

W. D. B.—So you flew from Philadelphia to Brooklyn? But why pick out such places?

By George! I do believe there's a boat going to come through this canal!
!
PAY TOLLS HERE
PANAMA CANAL
AERIAL EXPRESS
F. Fox

Why worry over canal slides when things will soon be like this?
—Courtesy N. Y. Eve. Sun.

(Continued from page 350)

employ as many aviators as are available from the Army, Navy, U. S. Army Aerial Reserve Corps, Naval Reserve Flying Corps, Aviation Sections of the Militia of different States, and instructors connected with civilian aviation schools, not only to create public interest in the Liberty Loan, but also to give experience to the military aviators in cross-country flying, and give a demonstration of the efficiency of the present Army and Navy aeronautic organizations.

The aviators attached to the military and civilian—or only the Army and Navy—stations will fly to other points within a radius of between 200 and 300 miles to different points of the compass, so as to practically touch simultaneously all the important geographical points by aeroplane, carrying educational pamphlets and circulars urging the public to buy Liberty Loan bonds.

For instance, two or more aviators from Governor's Island and Mineola can fly to Philadelphia; two or more to Troy and Albany; two or more to Buffalo. The aviators from Essington, Pa., can fly to Harrisburg, Pittsburgh, and other points. The aviators from Newport News can fly to Baltimore, Richmond, Raleigh, N. C., Lexington, Ky., and other important Southern points. The aviators from Buffalo, N. Y., can fly to Erie, Pa., Cleveland, Akron, Detroit and Toledo. The aviators from Boston can go to Portland, Me., and any cities in New Hampshire and Vermont. Aviators from Detroit can fly to Dayton, Cincinnati, Indianapolis, South Bend and Grand Rapids. The aviators from Chicago can fly to St. Louis, Springfield, Ill., Davenport and Des Moines, Ia., and Minneapolis. The aviators from Memphis can fly to Nashville, Tenn., Birmingham, Ala., Jackson, Miss., and Little Rock, Ark. Aviators from Fort Omaha can fly to Kansas City, St. Joseph and to important cities in Kansas, Nebraska, South Dakota and Minnesota. The aviators from San Antonio, Tex., and Columbus, N. M., can fly to cities in those States. The aviators from San Diego can fly to important cities in California, Arizona and Nevada. The naval aviators from Pensacola, Miami, West Palm Beach and Newport News can fly to the various cities along the coast.

If the plan of the Aviation Section of the U. S. Signal Corps to establish additional aviation stations throughout the country are far enough developed, it may be possible to have aviators cover the entire Lincoln Airway during one or more days, the aviators from different points flying to other points about 300 miles apart.

Whenever possible, the aviators, besides carrying educational pamphlets regarding the Liberty Loan bonds may carry members of the Liberty Loan Committee, who will on landing be received by the city authorities, and will deliver addresses urging the public to buy Liberty Loan bonds.

To add interest to the Aerial Rally, the Aero Club will present each aviator who reaches his destination a $100 Liberty Loan bond, and it is estimated that it may be possible to have as many as 100 aviators participating in the rally. If the rally only lasts one or two days, it will not take the aviators from their pressing duties, but will afford them experience in quick aerial mobilization, in cross-country flying, and give a demonstration of our increasing aerial preparedness. It will show that in the event of its being necessary to protect railroads, bridges, or important bases, the Army and Navy aviators could quickly be sent to the point to be protected.

The public interest that will be created in the Liberty Loan bonds by such a rally will be tremendous. There always has been great interest in aerial preparedness, and the fact that a portion of the funds to be raised by the Liberty Loan bonds is to be spent in the upbuilding of our aerial defenses will create additional public interest.

The decision as to the carrying out this plan rests with Brig.-Gen. George O. Squier, Howard E. Coffin, the Chairman of the Aircraft Production Board, and the Navy authorities.

EVERYTHING IN RUBBER FOR AIRPLANES

BALLOONS OF ANY SIZE AND EVERY TYPE

Extending Vision on Land and Sea

The far-ranging dirigible and the swift airplane overshadow for many the important function of the kite balloon.

But the perfecting of power-propelled aerial scouts has merely defined that function more clearly.

The kite balloon is necessary because it is a stable and readily available aid in determining ranges, in observing the effects of fire, in extending vision on land and sea.

Before the new Goodyear type was tested and approved the problems demanding better solutions were the primary ones of material and stability.

The former our work for many years on balloons of any size and every type has solved.

The latter demanded newly directed labor in design and ungrudging research in the field, in our own country and abroad.

The result of the Goodyear effort is the new Goodyear kite balloon—80 feet long and of 25,000 cu. ft. capacity.

Even as years of achievement have justified the Goodyear fabrics, exacting tests have justified the finned and reinforced tail cups and the design of every part.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
AKRON

A Lewis used as an anti-aircraft gun masked in wheat field
Official photograph (Crown copyright) taken on the front in France

"MODERN Warfare has developed a real necessity for machine guns both light and heavy, but as far as I saw, the Lewis Gun far outnumbered all other machine guns of the light type among the Allied armies.

"In the last engagement I saw in the recent Somme offensive, whole detachments were going into the trenches with every man carrying a Lewis Gun as one would carry an ordinary rifle."

WILL IRWIN
(War Correspondent, Saturday Evening Post)

SAVAGE ARMS COMPANY

Executive Offices: 50 CHURCH STREET, NEW YORK
Plant: 1671 SAVAGE AVENUE, UTICA, NEW YORK

THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

WRIGHT-MARTIN AIRCRAFT CORPORATION
60 Broadway -:- New York

Pigeons As Messengers

Mr. Frank J. Griffin has offered to supply the Aero Club of America with carrier pigeons to be used as a means of communication between aeroplanes and home stations to be established by the various Aerial Coast Patrol Units which have recently been formed.

Mr. Griffin in his letter says:

"It will be conceded without argument that a vital necessity exists for a method of communication between the aviator and his base station, not only to report important events coming under his observation but also injuries or difficulties to him or to his machine, in order that aid may be furnished at the earliest possible moment.

"Wireless is not available on our present flying machines for sending messages; homing pigeons are practicable, and are available for use in aeroplanes should they be required.

"In this connection, I might state that I have had the honor of being instrumental in some degree of the taking up of the pigeon service by the Signal Corps of the U. S. Army, and am at the present time assisting in the installation of lofts at various Government coast forts, and in particular at Governors Island and at Mineola Aviation Station, at which points the birds are to be used in connection with the aviation section of the Signal Corps.

"For your information, a homing pigeon will always return to the place from which it is first flown, and therefore, in the establishment of new lofts, we use young birds (squeelers as they are called), which are five to six weeks of age, and have never flown, giving them their first flight from the new loft; after a few months they are capable of flights of from 200 to 300 miles, and with reasonable care and attention are then practically 90 per cent. certain.

"These young birds are quite valuable, a bird of good stock being worth anywhere from $5.00 up each, but, as a matter of patriotism and to insure to the benefit of the fighting arms of our country, myself and various of my pigeon fancier friends are giving the birds to the Government at a nominal price of five cents a bird, to comply with the army regulations.

"The Signal Corps of the Army is now constructing a model loft, which, when completed, and approved as to details of construction, will be duplicated at various other points selected. Such a loft capable of housing 100 birds can be constructed and equipped for less than $100 per loft, and delivery of the birds to it could be had almost as soon as the loft is constructed.

"I feel safe in stating that if the Aerial Coast Patrol, the Naval Reserve Aviation Section and the Naval Militia Aviation Section wish to avail themselves of the use of homing pigeons I can secure for them as many birds as they require and free of all expense that is not absolutely necessary to comply with army or naval regulations."

Radio Operators in Military Aeronautics

Skilled wireless operators for the Mosquito Fleet are being recruited from the ranks of the amateurs, among whom there are many operators of the highest grade of skill and technical knowledge.

The Aeronautic Reserve will require a large quota of radio men and it is only from this field, the amateur wireless telegraphers, that they can be enrolled.

The practical skill of the amateur and his remarkable ability to secure the utmost distance with the limited power he was permitted to use by law, has caused him to establish distance records for a given power that have not been approached by naval and commercial stations. A large number of stations before the declaration of hostilities regularly communicated eight hundred and a thousand miles, and occasionally much longer distances.

The record established for transmitting, using one kilowatt of power, is three thousand miles overland—from New York to Los Angeles.

Radio telegraphy from aeroplanes is a recent art, and its widespread use in military aviation finds us wholly without trained reserves. The large number of young men who have taken up radio work from a pleasure standpoint are only partly trained, but obviously a partly trained man is more valuable than an untrained one.

The knowledge which he possesses is essential, but there remain many things which he must acquire to be a real military aviation telegrapher. The mere ability to tap a key in a room of his own home may make the amateur wireless operator believe that he can perform the same service while breezing along in a machine in flight, but it requires but one aeroplane flight to convince him that the continuous vibration of an aeroplane in flight is not as comfortable or as easy a place in which to operate.

His physical and nervous system must first be trained to maintain its full control over his hand and brain so that he can operate his aeroplane radio set with the ease that he can operate a land station.

The aspiring radio man must perform the function of observer as well as wireless operator. In the British training system, all military pilots are taught the elements of the art of radio telegraphy. While we are probably going to follow the British curriculum in the training of our own airmen, the lack of facilities for training pilots and the immediate need for all we can procure may find us using radio operators who have been trained as observers, without being pilots. In fact, such a course would cut in half the training time of each man, since the acquirement of even a working knowledge of radio telegraphy takes many weeks of conscientious work.

Hence men who possess knowledge and experience in radio telegraphy may be used as passenger observers and operators. The training of an observer, however, is no small task. It includes a thorough study of military terminology and theory, so that only facts of importance and value are reported. The spotting of artillery fire also requires study and practice in the judging of distances.

With the expanded use of aeronautic radio for military purposes, the duties of operators become doubly important. Increased range and efficiency of aeroplane transmitters now makes it possible to report observations during long distance scouting trips; and there have been cases reported of attacks of infantry being directed by officers in aeroplanes—their orders being sent to the troops below by radio.

To supply this need of men in aeroplane radio operators, we have a large field of young men to draw from. The amateur licenses held by American citizens number more than ten thousand. To hold a Government license these men have passed an examination both in theory and code, and in practise become very skilled operators. Before the war, 65 per cent of the operators of the Marconi Service were recruited from amateur operators.

With numerous records of skill and efficiency in the radio art, and in many cases possessing the physical qualifications necessary for aeroplane work, the wireless amateur who has some knowledge or interest in aeronautics forms a desirable and advanced recruit in military aviation. The need for men in the Naval Reserve Flying Corps of such qualifications is an important one, and information regarding terms of enlistment can be secured at 26 Cortland Street, New York City.

The
General Aeroplane Company

offers special facilities for the efficient instruction of Aerial Coast Patrol Units

Constructors of Land and Water Aircraft

Wire or Write

GENERAL
AEROPLANE
COMPANY
1507 Jefferson St.
East
Detroit Michigan

ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

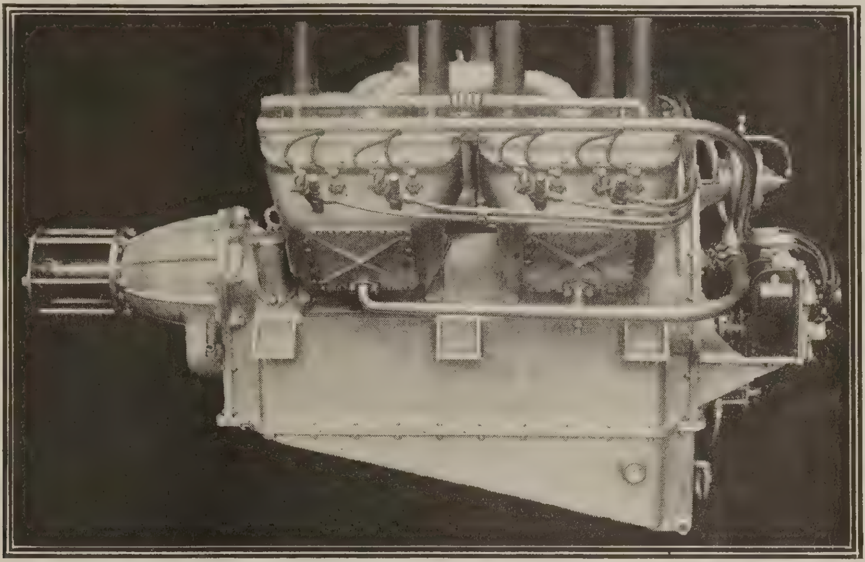
Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps, and Sperry Map Holder, supply this necessity.

The map can be turned easily in the holder bringing constantly before the aviator a chart of the locality above which he is flying.

The equipment is light in weight and can be fixed to instrument board without interference with the other instruments.

Prices and details on application.

The Aeronautic Library, 280 Madison Avenue, New York City



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THOMAS AEROMOTORS

A **Special Christensen Self Starter** forms an integral part of the engine.

Contractors to U. S. Army and Navy

THOMAS-MORSE AIRCRAFT CORPORATION

Successors to THOMAS BROS. AEROPLANE CO., Inc. THOMAS AEROMOTOR COMPANY, Inc. *Ithaca, N. Y.*

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Builders of AIRCRAFT

Military Airplanes
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Reflected in the enduring service rendered by every HESS-BRIGHT Ball Bearing is the infinite care exercised in its manufacture. The rigid standards to which all materials must, by test, conform—the gauging and testing of each piece after every operation—the final inspection which maintains uniform microscopic accuracy in the finished bearing—these are the methods which build into the HESS-BRIGHT Ball Bearing the ability to run for years without appreciable wear.

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Established 1883

WORCESTER, MASS., U. S. A.

Popular Books on Aeronautics

The Flying Machine; From an Engineering Standpoint, by F. W. Lanchester	$3.00
Mechanics of the Aeroplane, by Capt. Duchene	2.50
Flying for France, by James R. McConnell	1.00
Aeroplane Designing for Amateurs, by Lougheed	1.00
Radiodynamics, by B. F. Meissner	2.00
Flying: Some Practical Experiences, by Gustav Hamel & C. C. Turner	4.00
The Properties of Aerofoils and Aerodynamic Bodies, by A. W. Judge	6.00

THE AERONAUTIC LIBRARY
280 Madison Avenue
New York City

is prepared to supply any of these books. Send remittance to cover, plus ten per cent additional for postage, and your order will be promptly filled.

The Buck Automatic Aerial Torpedo

After a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

The Buck Aircraft & Munition Co., Inc.
Ernst and Cranmer Building
Denver, Colo.

Fine Factory for Rent

Within 4 Miles of City Hall, Philadelphia

This property of 11 Acres with 450 feet front on DELAWARE RIVER is near Philadelphia NAVY YARD and in close proximity to

Two Trunk Railroad Lines

The Buildings are One and Two story Brick, containing about 150,000 SQUARE FEET OF FLOOR SPACE, with ample Yard Room and POWER PLANT. LABOR Conditions are excellent. Possession can be given IMMEDIATELY.

FOR FULL PARTICULARS APPLY TO
ANCONA PRINTING COMPANY
826 Commercial Trust Building Philadelphia, Pa.

THE TURNER AVIAPHONE

Used by the Russian Government

Makes conversation possible between pilot and passenger.

Invaluable for military use because the officer can direct the pilot in scouting.

Indispensable when maps or photographs are to be made, because both hands are left free.

Mouthpiece in position only during conversation.

Light and Convenient

Outfit consists of 2 Head Caps, 2 Receivers for each user, light-weight Battery and Cords. Weight complete, 5 lbs. 5 ozs. Receivers Adjustable to any type of headgear.

Write Us To-day

GENERAL ACOUSTIC CO., 220 WEST 42d ST. NEW YORK

Burgess Primary Training Tractor Type B. P.

This machine was designed by W. Starling Burgess at the request of the United States Army for a primary training tractor aeroplane having a practical side by side seating arrangement with duplicating controls.

This has been accomplished without sacrificing in the least the efficiency or appearance of the machine.

It fills the urgent need found at present in the aviation schools—giving great range of control and allowing the instructor to be at side of the pupil during flight, thereby facilitating instruction.

This has proven very satisfactory in experimental flights as well as in the official trials thru which this machine passed with great success.

THE BURGESS COMPANY
MARBLEHEAD, - - MASS.

Manufacturers of the Burgess-Dunne and Burgess seaplanes.
Sole licencees for the Dunne patents.

SPERRY APPARATUS
for Aeronautic Defense

Synchronized Drift Set
Standard Equipment U. S. Army.
Awarded Collier Trophy, 1916

Automatic Pilot
Enables Pilot to
Drop Bombs, Make Maps, Etc.
Awarded Collier Trophy, 1914

Air Compasses
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The Sperry Gyroscope Company
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THE WILSON CABINET COMPANY announce that they have a large plant containing 50,000 feet of floor space, with equipment ready to immediately manufacture aeroplanes of all types to specification. Correspondence invited concerning details of the facilities available.

WILSON CABINET COMPANY
NASHVILLE, TENNESSEE

Duesenberg Motors Corporation has been organized to manufacture Aeroplane, Marine and Automobile Motors for those who can afford and demand the best.

DUESENBERG MOTORS CORPORATION
120 Broadway, New York City

BENOIST

Cross-Country planes and flying-boats have six years' actual building experience back of them.

Four Standard Models. Single and Twin motored three to seven passenger machines.

On application by interested parties, we will submit specifications on triple and four motored machines carrying as many as twenty passengers, and guarantee performance.

Benoist Aeroplane Company
SANDUSKY, OHIO

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Aircraft Metal Parts

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THE ERIE SPECIALTY COMPANY

Builds its productions with

PERFECTION

the desired result. The users of Erie Standard Aircraft Parts are assured of a product complying fully with any government specifications. (Send us your requirements, and we will submit estimates and delivery dates.)

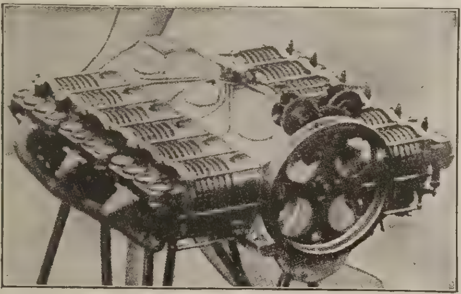
ERIE PENNSYLVANIA

RICHARDSON AEROPLANE CORPORATION

INCORPORATED

LAND and WATER AIRCRAFT

NEW ORLEANS - - LA.



¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

ASHMUSEN HIGH GRADE POWER PLANTS

ARE NOW READY FOR THE MARKET

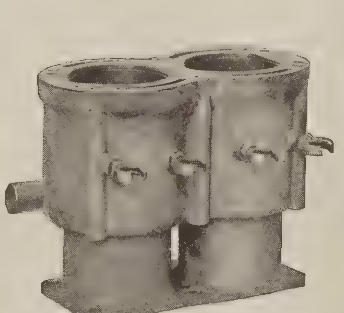
Patents allowed and pending.

They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
Ignition—High Tension Magneto.
Carburetor—Improved ASHMUSEN.
Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11½ Gals. per hour, Low Grade.
Oil Consumption—70 H.P.—¾ Gal. per hour, Good Grade.
Oil Consumption—105 H.P.—1¼ Gals. per hour, Good Grade.

ASHMUSEN MFG. CO

266 Pearl Street, Providence, R. I., U. S. A.



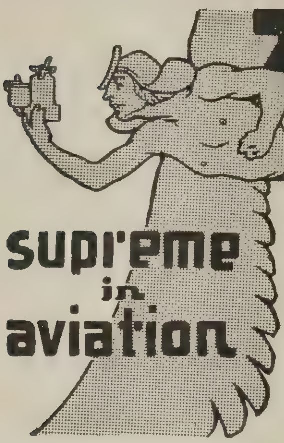
Sturtevant
(REG. U.S. PAT. OFF.)

CYLINDERS AND SLEEVE

The aluminum cylinders are cast in pairs and are carefully fitted with removable steel sleeves.

These two features contribute largely to the lightness and endurance of Sturtevant Aeronautical Engines.

B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass.



ZENITH

All recognized builders of airplane motors in America use *Zenith* on their product.

Zenith Carburetor Company

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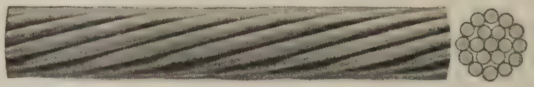

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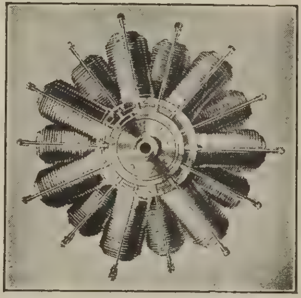

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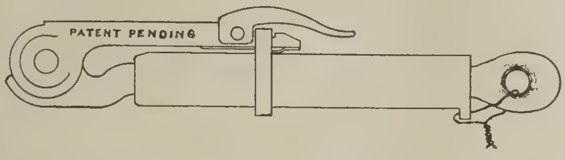
A Labor and Time Saving Invention

The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



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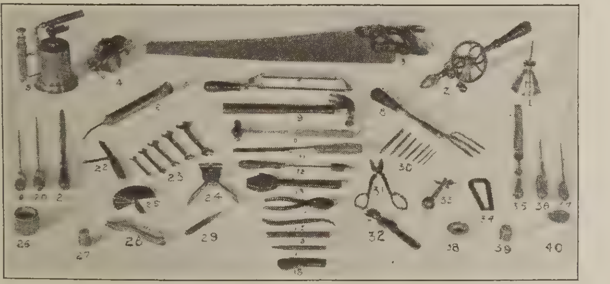

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Announcement

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PERFORMANCE

The New York Aero Construction Company's Twin Motored Seaplane has a maximum speed of 85 miles per hour, excelling the estimate by ten miles per hour. Yet it has a slow landing speed of 43 miles per hour, allowing the landings to be made within a much smaller space than is ordinarily the case. But what is even more important in coast defense work is the fact that it has a

FLYING RADIUS OF NINE HOURS

The advantages of a high speed and a wide flying range are obvious. The coasts of the United States are long, and the swifter the machines that guard them, and the longer they can stay in the air, so much better and more easily are the coasts patrolled. The seaplane mentioned in the editorial of the World could, flying at full speed for its seven hours' flying radius, cover 515 miles. The seaplane of the New York Aero Construction Company could cover 680 miles.

820 Sq. Ft. Supporting Surface.
Two 100 H.P. Aeromarine Motors.
Weight 2,700 lbs. Useful load 1,700 lbs.
Maximum speed, 85 Miles per hour.
Minimum speed, 43 Miles per hour.
Flying radius, nine hours.

Designed and constructed throughout under the supervision of Mr. Warren S. Eaton.

NEW YORK AERO CONSTRUCTION COMPANY, Factory, Newark, New Jersey

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REMARKABLE NEW AEROPLANE DOPE AND REAL FIRE-PROOF PAINT

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This remarkable new Dope, besides being absolutely fire-proof, will by our process render your plane fabrics

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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed without in any way affecting the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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AEA Aeronautics

AERIAL AGE
WEEKLY

Vol. 5, No. 12 JUNE 4, 1917 10 CENTS A COPY

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A Burgess-Dunne Seaplane at a U. S. Naval Aeronautic Station

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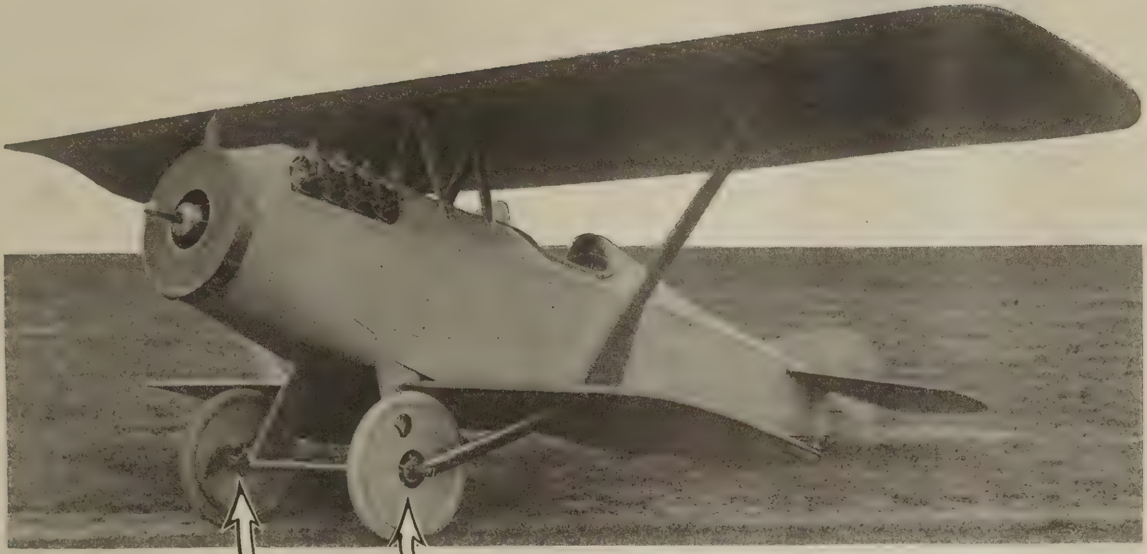
Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities
THE CURTISS AEROPLANE CO., Buffalo, N. Y.



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THE SPOKES"

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C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

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Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

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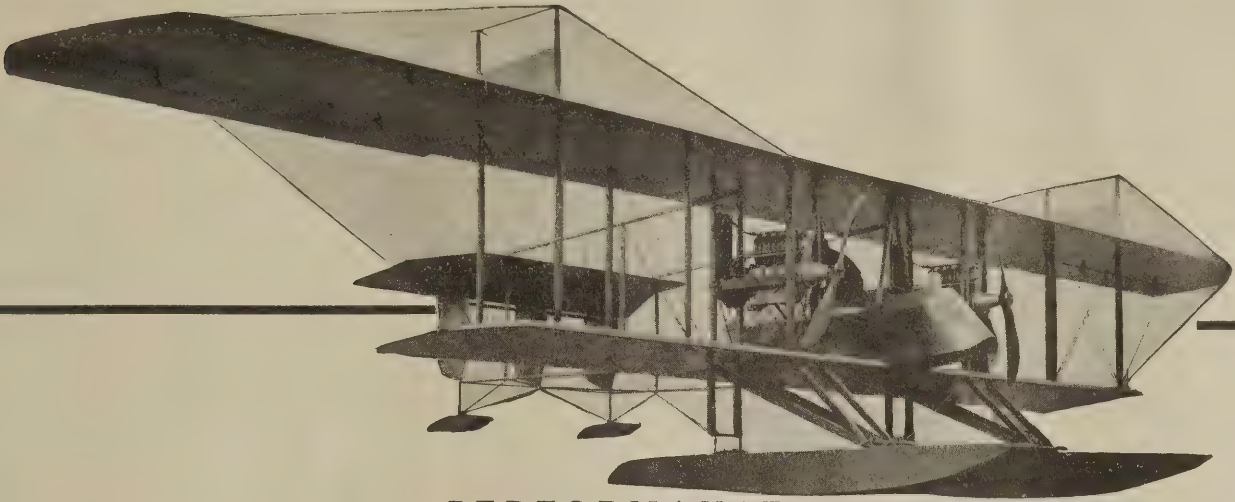

PERFORMANCE

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FLYING RADIUS OF NINE HOURS

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Two 100 H.P. Aeromarine Motors.
Weight 2,700 lbs. Useful load 1,700 lbs.

Maximum speed, 85 Miles per hour.
Minimum speed, 43 Miles per hour.
Flying radius, nine hours.

Designed and constructed throughout under the supervision of Mr. Warren S. Eaton.

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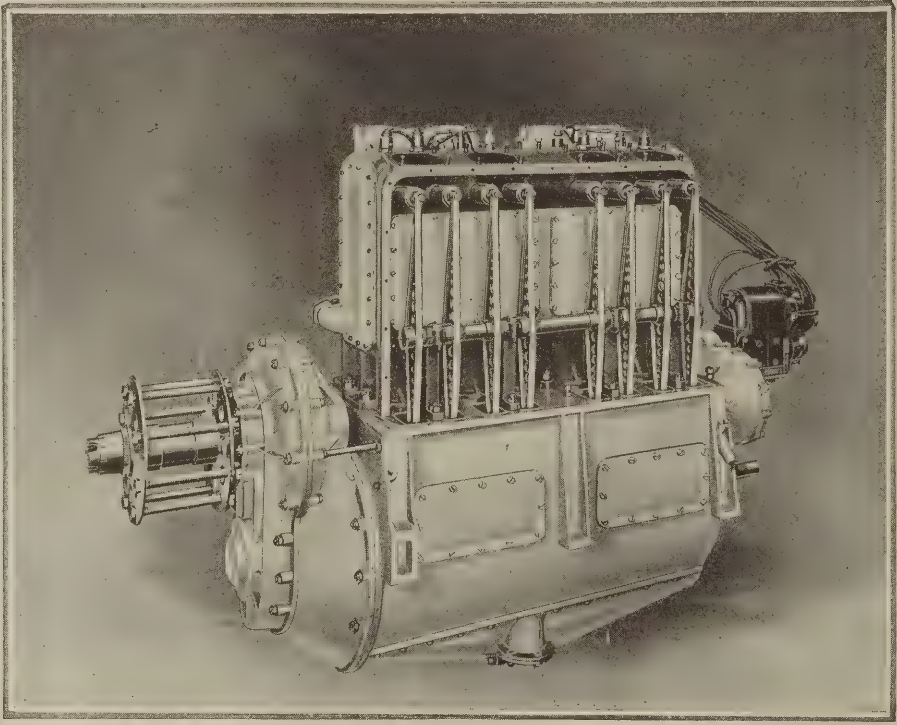

ILLUSTRATION WITH VALVE COVER REMOVED TO SHOW VALVE ACTION

Brief Specifications

Sixteen Valve Duesenberg Aeroplane Motor

FOUR cylinder 4¾" x 7", 125 H.P. at 2100 R.P.M. of the crankshaft and 1210 R.P.M. of the propeller. Motors are sold on above rating; actual power tests prove this motor capable of developing 140 H. P. at 2100 R. P. M. of the motor. The exact weight with magneto, carburetor, gear reduction and propeller hub, as illustrated, 509 lbs. Without gear reduction, 436 lbs. Net price of this four cylinder motor with regular engine equipment but not with reduction gear, $3050.00; net price with reduction gear, $3500.00.

Cylinders are semi-steel with aluminum plates enclosing water jackets. Pistons specially ribbed and made of Magnalite aluminum compound. Piston rings of special Duesenberg design, being three piece rings. Valves are Tungsten Steel, $1\frac{15}{16}$" inlets and 2" exhausts, two of each to each cylinder. Arranged horizontally in the head, allowing very thorough water-jacketing. Inlet valves in cages. Exhaust valves, seating directly in the cylinder head, are removable through the inlet valve holes. Valve stems lubricated by splash in the valve action covers. Valve rocker arms forged with cap screw and nut at upper end to adjust clearance. Entirely enclosed by aluminum housing as is entire valve mechanism. Connecting rods are tubular, chrome nickel steel, light and strong. Crankshaft is one piece forging, hollow bored, 2½" diameter at main bearings. Connecting rod bearings 2¼" diameter, 3" long. Front main bearing 3½" long; intermediate main bearing 3½" long, rear main bearing 4" long. Crankcase of aluminum, barrel type, oil pan on bottom removable. Hand hole plates on both sides. Strongly webbed.

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Duesenberg Motors Corporation

120 Broadway, New York City

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AERIAL AGE
WEEKLY

HENRY WOODHOUSE
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THE TRADE AUTHORITY
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Subscription Price, $4.00 a year, Foreign, $5.00. Telephone, Murray Hill 7489

VOL. V NEW YORK, JUNE 4, 1917 No. 12

TO TRAIN THOUSANDS OF AVIATORS AND PRODUCE TENS OF THOUSANDS OF AEROPLANES TO STRIKE GERMANY THROUGH THE AIR

"We Must Strike Germany Through the Air" is the new slogan which has resulted from the meeting in Washington between members of the Aircraft Production Board of the United States and the Board of Governors of the Aero Club of America, after lengthy study of the present war situation and of the ways and means of carrying on an effective campaign of education on behalf of the Allies.

Mr. Alan R. Hawley, the president of the Aero Club of America, who returned yesterday from Washington, issued the following statement:

"Germany's U-boat warfare and the necessity of keeping the German fleet bottled up are occupying the navies of the Allies, and no decisive victory over the Germans is expected in naval actions in the near future. Likewise advances against the Germans on land are slow and Germany has seemed able so far to always throw new thousands of men and new lines of trenches and countless guns to meet the advance of the Allies. The only victories on the part of the Allies so far have been as a result of supremacy of the air, as a result of the matching of skillful, daring Allied aviators against German aviators and observation balloons; the recent British and Italian victories were preceded by countless aerial fights in which hundreds of aviators took part, and it was not until the skies had been cleared of German aviators and of German observation balloons—and the Germans were thereby deprived of the aerial eyes of the infantry, of the aerial scouts and the Allies aviators, being masters of the air, could follow the movements of the enemy and locate their batteries and their strongholds—that the victories became possible.

"These facts are known to the men who, although pressed by the countless details of preparing this country to do in a few months what should have been done in the past years—still are able to look upon the situation from the broadest aspect and to see in which direction lies the possibility of accomplishing the utmost against Germany in the least period of time. While the United States is beginning to help substantially now, effective help of the kind that leads to permanent victory can only come at the end of months of preparation, and in considering in which way we can best prepare to help to achieve permanent victories it is found that the aerial branch of the service affords the greatest possibilities. British, French, Russian, Italian and American authorities who have studied the matter closely have come to the conclusion that the addition of 10,000 aviators to-day to the Allies' present aerial forces would insure blinding the German batteries and preventing German aviators from conducting operations over or near the Allies' lines. An additional 10,000 aviators would make it possible to conduct aerial raids on a large scale and to strike Germany in the most vital places, to strike hard enough to lead to permanent victories."

Authorities in Perfect Agreement on Issue

The authorities who met in Washington, although they had all thought separately and had all made plans separately from information secured from independent sources, readily agreed in that one thing—that every effort should be concentrated in striking Germany through the air.

Several instances during the meeting emphasized that although different people present had secured their information from separate sources, their information was practically alike. For instance, when one of the authorities present stated that he would read a certain communication from Europe giving a résumé of the situation, Mr. Henry A. Wise Wood, the chairman of the Conference Committee on National Preparedness, asked permission to retire to another room until the communication had been read, because, as he stated, he had prepared an address to deliver the following day on the situation from information secured from independent sources, and did not want to place those present and himself in the embarrassing position that might follow if the information was similar, so he stepped out of the meeting room until the communication was read. When he returned and he stated the nature of the information that he had and which he would include in an address there was found that it was exactly like the information contained in the communication which was read at the meeting.

The meeting of the Board of Governors of the Aero Club of America was held in Washington and Mr. Howard E. Coffin, the chairman of the Aircraft Production Board, who is also a member of the Board of Governors of the Aero Club of America, presided. The members of the Board of Governors of the Aero Club present were: Alan R. Hawley, president of the club, and Messrs. James A. Blair, Jr., W. Redmond Cross, Charles Jerome Edwards, Max H. Fleischmann, John Hays Hammond, Jr., Captain James E. Miller, Raymond B. Price, Henry A. Wise Wood and Henry Woodhouse.

Having reached the conclusion that efforts must be concentrated to get and train thousands of aviators and lay plans to manufacture tens of thousands of aeroplanes of different types for training, bomb-dropping, artillery spotting, fighting machines and submarine destroyers, the Board next turned to consider the way and means of getting the aviators and machines.

Facilities to be Greatly Extended

To do this the aviation training facilities and the sources of supplies for aircraft must be greatly extended. It was pointed out that at the beginning of the war Great Britain did not have one-third of the aeronautic manufacturing facilities that we have in the United States to-day and there was read a statement from the British Comptroller of Aeronautic Supplies reporting that there are 958 firms engaged on work for the British Directorate of Aeronautic Supplies, 301 of which are direct contractors and 657 are sub-contractors. This report states that the total number of hands employed by the fifty firms of most prominence is 66,700.

Great Britain Spending $575,000,000 for Aeronautics

There was also brought out the fact that the present British budget for aeronautics for the present year totals $575,000,000. These are made public as a result of their publication in connection with a discussion which took place in the House of Commons recently. England and France had to come up from a production of a few aeroplanes per month to the present production of about 4,000 aeroplanes per month and have had to do that with limited resources in personnel and materials. The United States to-day has a better start than either France or England had at the beginning of the war, and it has tremendous resources in workmen and materials.

It is all a question of making a plan extensive enough to insure large production and of placing orders for continuous deliveries of aeroplanes and training of aviators and mechanics in large numbers. To do that there will be required large appropriations but no trouble is anticipated in that direction. The members of the Board of Governors of the club who discussed the matter with members of Congress were the same men who last year went to Congress to urge the increase of the appropriations for aeronautics from $3,000,000 to $30,000,000. Congress allowed $18,000,000 last year and the members of Congress seen by Governors of the Aero Club state that they appreciated that the increasing of the appropriations last year gave us a year's start in the manufacturing of aeronautic products. Now they appreciate the necessity of looking ahead again and providing for adequate expansion. For obvious reasons, the details of the plans for expansion cannot be made public. But sufficient is made public to assure the American public that proper attention is being given to meeting this need for large numbers of aeroplanes and aviators.

General Squier's Plans for Training

The Government's Committee on Public Information has issued the following statement regarding part of the details of the steps already taken to train aviators in large numbers:

"Last month a group of Army officers visited the training camp of the Royal Flying Corps at Borden, Ontario, one of the four camps established in Canada, and the aviation school at Toronto, where cadets are trained under military discipline for the service. In these schools there has been incorporated the latest European experience in the development of this new art of the air.

"Our officers were deeply impressed with their observations and as a result we called together here the heads of six prominent engineering schools which also have military training and made plans to establish a similar system in the United States. The six institutions are the Universities of California, Texas, Illinois and Ohio, Massachusetts Institute of Technology and Cornell University. Three technical instructors from each of these places were sent to Toronto. They returned on May 8 after a comprehensive study of the course given there, prepared to teach it themslvs. On May 10 these six engineering schools opened similar cadet aviation schools at their respective institutions.

"These cadet schools might be described as laboratory courses in aviation. The students are given thorough instruction in the theory of flying, including the necessary physics and mathematics and the mechanics of aeroplane construction. The training schools are thoroughly equipped with samples of aeroplane parts and instruments for demonstration as well as text-books. Technical matters relating to map making, photography, bomb-dropping, gun sighting and all similar subjects which a military aviator must know are also taught. All during this time the cadet is under military training, following the methods which Great Britain and Canada have found so successful. At the end of two months of this preliminary work, the cadet is given a final test to determine whether he shall go on to the aviation camp.

"General Squier's office has been handling these schools. All applications from persons who wish to become military aviators have been turned over to this department over which Professor Hiram Bingham, of Yale, has been given general direction by General Squier, and there have been far more applicants than could be admitted. The schools began on May 10; twenty-five cadets a week are entering each of the six colleges, which means that as soon as the first entering class completes its preliminary work, approximately 150 students a week will be available for the regular training camp with a good ground work on which to start their practical training. There will be 600 cadets in the six colleges by July 1st. In the meantime plans are going ahead from the nine aviation fields to receive their men when they are ready. The Aircraft Production Board is working constantly with the military departments in preparing for the construction of these fields. The standard field on which we are basing our program will provide for accommodating two squadrons of 150 students each with the necessary officer, instructors and enlisted men, together with a certain number of additional enlisted men who will be trained at the same time. The hangars will take care of seventy-two planes. The preparation of these fields will cost approximately a million dollars each, including the construction of the necessary buildings, dormitories, work shops and hangars. A standard set of buildings has already been worked out, the fields will be approximately a mile square, and great care is being taken by the military officers in their location.

"We are estimating about four months as the period for getting these students ready for Army service.

"The Aircraft Production Board is working hard to assist the military departments in their plans to have all these related activities co-ordinated—to have the preliminary schools turn out their cadets in order to fit into the plans for the training camps, and at the same time to get the necessary training machines ready in time for their use. These new plans will not interfere in any way with the present use of the four aviation fields the Government now has nor with private initiative.

Aircraft Manufacturers' Association Co-operating

"Both the manufacturing problem and the training problem will be much simplified the second year if we can establish the proper co-ordination of effort this year. The manufacturing capacity can easily be doubled the second year. In securing the co-operation of the manufacturers in placing their facilities at the disposal of the Government, we have found the organization of the Aircraft Manufacturers' Association, effected last February, of great assistance.

"A prominent British general has asserted that America's greatest contribution to the war will be aircraft and aviators. We believe that once started upon quantity production American mechanical genius will overcome any present obstacles to the progress of the art.

"The Aircraft Production Board is acting in the closest cooperation with the War and Navy Departments, especially with the recently created Joint Army and Navy Board on Design and Specifications, which has been entrusted by the two Secretaries with discretion on all questions of design and specifications in all forms of military aircraft except Zeppelins. The membership of this Joint Board includes the following: Major B. D. Foulois, U. S. A.; Captain V. E. Clark, U. S. A.; Lieut. A. K. Atkins, U. S. N.; Lieut. Comm. J. H. Towers, U. S. N.; Asst. Naval Constructor J. C. Hunsaker, U. S. N.; Captain E. S. Gorrell, U. S. A.; Henry Souther, the consulting engineer of the Signal Corps will act in a similar technical capacity to the Aircraft Board.

"The general function of the Aircraft Production Board is to bring manufacturers together and help make their resources available to the Government and assist the Government in stimulating the production of better types and greater quantities of air machines, to investigate and recommend manufacturing plants where orders are to be placed, to aid in arranging with American factories as to the kind of machines best suited to their several organizations and facilities for manufacture, to advise as regards priority of deliveries of aircraft material in accordance with a general policy as determined by the Council of National Defense, and following the selection of sites for Aviation Schools and supply depots by the Military Department, to advise in regard to buying or leasing the land, preparing it for use and erecting all buildings."

Aero Club of America Greatly Pleased Over Plans—Offers Hearty Co-operation

The members of the Board of Governors of the Club who attended the meeting agreed not to add to the information given out by the Committee on Public Information but they—including the aeronautic experts who have in the past few years been urging aerial preparedness on a large scale, and are usually considered very critical in their views—expressed themselves as being fully satisfied with the general plans of action. The Board of Governors of the Club, as a whole, assured the Aircraft Production Board of the hearty cooperation of the Aero Club of America and its affiliated aero clubs and pledged their co-operation in every way possible for carrying out the plans. Chairman Coffin of the Aircraft Production Board, asked the Board of Governors to continue their work in assisting in recruiting aviators and mechanics, stating that although thousands of applications have been received, such a large number of men are needed to make aviators and mechanics, that it is desirable to have as many applications as possible in the Chief Signal Office of the Army.

The members of the Aircraft Production Board besides Chairman Coffin are Brig. Gen. George O. Squier, Chief Signal Officer, U. S. A.; Rear Admiral D. W. Taylor, Chief of the Bureau of Construction, U. S. N.; S. D. Waldon, former Vice President of the Packard Motor Car Company; E. A. Deeds, former General Manager of the National Cash Register Company, after with the Dayton Engineering Laboratory Company, and head of the Miami Conservation District formed to guard against a repetition of the Dayton flood, and R. L. Montgomery, senior member of the Philadelphia firm of Montgomery, Clothier and Taylor, who is serving as financial and business advisor of the Board.

THE NEWS OF THE WEEK

College Balloon School

Washington.—The Collegiate Balloon School, to train men in the operation of lighter than air machines—the first to be established in the United States—is to be located at New Haven, Conn., under authority of the War Department, where the facilities and equipment of the Connecticut Aircraft Company will be utilized. New England universities and colleges are expected to supply the majority of the students, who will be admitted to the school through the department and who will be obliged to conform to the requirements of the military regulations.

General Squier has communicated with Colonel Isaac M. Ullman, president of the New Haven Chamber of Commerce, expressing the interest of the department in the enterprise and declaring a readiness to make an agreement for the training of army flyers at New Haven. It is expected that within a short time 200 men will be stationed at New Haven to be instructed in the art of operating dirigibles, spherical balloons and kite observation balloons. Students from Yale, Harvard, Amherst, Trinity and other educational institutions have interested themselves in this branch of aeronautics and will make up the bulk of the student body of the school. Plans are now being perfected for starting the training course at an early date.

Italian High Commission Arrives

Headed by the Prince of Udine, who is also a captain in the Italian Navy, the Italian War Commission reached Washington on May 23. The members were met at Union Station by Secretary of State Lansing, Counsellor Polk and the Italian Ambassador, Count di Cellere. They were escorted from the station to the home of Joseph Leiter in Dupont Circle, which had been placed at their disposal during their stay. Two troops of Cavalry preceded the automobiles. Other members of the commission accompanying him were: Marquis Luigi Borsarelli di Rifreddo, Under-Secretary of State for Foreign Affairs; Guglielmo Marconi, inventor of the wireless; Senator Augusto Ciufelli, formerly Minister of Public Works; Francesco Severio Nitti, formerly Minister of Agriculture; Cavalliere di Parente, Secretary of Legations and Missions; Naval Lieut. de Seara; Cavalliere Alviz Bragadin and Cavalliere Guido Pardo, secretaries; the Duca di Sangro, Signor di Sousa, Cavalliere Angeli and Cavalliere d'Amato. Accompanied by members of the mission and by his American aids, Lieut. Col. John C. Gilmore, Jr., U.S.A., and Lieut. Comdr. William N. Jeffers, U.S.N., the Prince of Udine and other members of the mission called on the Secretary of State on the following day and later on Secretary of the Navy Daniels. From the office of Secretary Daniels the members of the mission went to the White House to pay their respects to the President. In the evening the commission were guests at a dinner at the White House.

Insignia for U. S. Aircraft

The Secretary of the Navy on May 21 issued a general order providing for the adoption for Navy aircraft of a white star with a red center on a circular background of blue as the distinguishing insignia of the third arm. This insignia, which will be carried also by the Army aeroplanes, is described as follows: "A five-pointed white star inside of a blue circumscribed field, with the center of the star red. The diameter of the circumscribed circle will be equal to the chord of the wing on which the insignia is placed. The diameter of the inner circle will not extend to the inner points of the star by an amount equal to one twenty-fourth of the diameter of the circumscribed circle. The inner circle will be painted red; that portion of the star not covered by the inner circle will be painted white and that portion of the circumscribed circle not covered by either inner circle or star will be painted blue. The shades of red, white and blue will be the same as those used in the American Flag."

The order in regard to naval craft continued: "One of each of these insignia will be placed on the upper surface of each upper wing, and one of each in a corresponding position on the lower surface of each lower wing. Both sides of that portion of the rudder which is in rear of the rudder post will be painted with three equally wide bands, parallel to the vertical axis of the aeroplane and colored red, white and blue of the same shades as mentioned hereinbefore, the blue band being nearest the rudder post, the white band in the center, and the red band at the tail of the rudder.

"One of these insignia will be placed on top and one on bottom of gas bag of dirigible balloon, the center of each insignia being in the vertical plane through the fore and aft axis of the gas bag. The center of insignia on top will be sixty feet from forward end and the center of insignia on bottom will be just forward of suspension band. The circumscribing circle of insignia for dirigible will be five feet in diameter. The rudder of each dirigible will be marked in a manner similar to that applied to aeroplanes, except that stripes will not exceed five feet in length or eighteen inches in width. If there is more than one rudder only the outboard side of each outboard rudder will be marked. One of these insignia will be placed on top and bottom of gas bag of captive balloon, the center of each insignia being in the vertical plane through the fore and aft axis of the bag, and two and one-half feet aft of the seam joining nose to main body. The circumscribing circle will be five feet in diameter. The building number of each aircraft will be placed in figures three inches high on each side of the rudder, at the top of the white band hereinbefore mentioned. No other markings shall be placed on any Navy aircraft, except such as may hereafter be prescribed. All Navy aircraft will be immediately marked in accordance with this order, and in future, specifications for Navy aircraft will require that the contractors place the building number and distinguishing insignia on all aircraft, and on such spare parts as bear these marks in completed aircraft."

Frithiof G. Ericson, Chief Engineer of the Canadian Aeroplane, Limited, who was recently appointed a member of the Ministry of Munitions in Canada.

Arrangements Made for Aviation School

Columbus, O.—Professor William T. Magruder of the department of mechanical engineering, Professor Henry C. Lord of the department of astronomy, and Professor William A. Knight of the department of industrial arts of Ohio State University, have returned to Columbus from Toronto, Canada, where arrangements were completed for the work of the aviation camp which is to be established on the campus of the university. The camp, which may be started by June 1, will accommodate 200 students. The course will take eight weeks for completion, after which the students will go to Dayton for actual flying lessons.

In order to take the course, enlistment must be made in the aviation division of the signal corps of the regular army. The regular blank received at any local recruiting station must be filled out and sent with three letters from reputable citizens to Washington to the chief signal officer of the United States Army, and the regular physical examination must be passed. If accepted, the applications are to be sent to the nearest cadet aviation school for three weeks of intensive drill.

$325,000 Sought for Air Stations

Washington, D. C., May 24.—An appropriation of $325,000 for acquiring coastal air stations at Cape May and other points was requested of Congress today in a communication from Josephus Daniels, Secretary of the Navy, to Champ Clark, Speaker of the House.

"The navy has adopted in its plans for the establishment of coastal air stations at various points along the coasts," Mr. Daniels said. "Thorough investigation of sites on the Atlantic, Pacific and at Pearl Harbor have been made by boards appointed for this purpose and reports submitted. Every effort has been made to locate these stations on government land, but there remain certain sites which can only be leased or purchased. In view of the fact that some of these stations should be permanently acquired by the navy, it is strongly recommended that such sites be purchased."

Aviation School for Oklahoma

Tulsa, Okla.—Under arrangements perfected between the Chamber of Commerce and G. L. Bumbaugh, an aviator and aeroplane manufacturer, there will be located here within the next few weeks an aviation school and factory for the manufacture of aeroplanes to be used privately and in the government service.

Captain Bumbaugh was present at the noonday luncheon of the board of directors of the Chamber of Commerce and presented a brief outline of his plans, which were accepted as entirely feasible. In connection with the school, although under separate business management, the captain will conduct an aeroplane manufacturing plant which has been financed by local capitalists.

Minnesota Aero Club Organizing

Fifty prospective aviators already are waiting for completion of the plans for the Minnesota Aero Club that they may start training.

The club is being organized at the request of the Aero Club of America, who asked Mr. R. M. Newport to start a campaign for members.

Mr. Newport, with the assistance of J. A. O. Preus, state auditor, received word from fifty men who wish instruction and he said that the club will have a membership of more than 200 within a few months.

Admiral Peary is to speak in St. Paul June 20 at a meeting of the Minnesota State Bankers' Association, and if the Aero Club is fully organized at that time, will address the airmen.

Mr. Newport said, should enough members enlist, the government will probably furnish a commissioned instructor and aeroplanes.

Miss Marie Peary Soon to Be Bride

Rear Admiral and Mrs. Robert E. Peary announce the engagement of their daughter, Miss Marie Anighito Peary, to Edward Stafford, son of Justice Wendell P. Stafford, of the Supreme Court of the District of Columbia.

No date has been set for the marriage of Miss Peary and Mr. Stafford, as he has applied for a commission in the Officers' Reserve Corps.

Mr. Stafford is a graduate of Dartmouth. Miss Peary was born farthest north of any white child, her mother having accompanied Admiral Peary on one of his trips to the Arctic, and is widely known as the "Snow Baby." She is singularly unaffected and charming, and has many warm friends in Washington, where she has lived most of her life. She is a member of the Junior League, has been active in philanthropic work, and is keenly interested in aviation. She learned to fly under the tutelage of her father, who is a governor of the Aerial Club of America, and a member of the Aerial Coast Patrol.

Expert Mechanics Needed

The Aero Club of America has received a call for mechanics, expert in gas explosion engines, who are willing to enlist in the Aviation Division of the United States Army for foreign service. The men wanted for this purpose must be experts in gas engines.

Their pay will be from $36 a month to $75, with twenty per cent additional for foreign service, with all clothing, food and expenses of transportation additional. Applicants should apply to the Aero Club of America, No. 297 Madison Avenue.

There will also be opportunity for young men of good character desiring to enlist as privates and be attached to this organization. This is one of the most important branches of the service, and will afford valuable experience to suitable applicants, and the discharge from the service as aviation mechanicians after the period of the war will be invaluable in the aviation industry.

School for Eastern Illinois

Danville, Ill.—The government is planning to establish an aviation field and school in Eastern Illinois some time in the near future. A committee is visiting a number of locations and has just completed a tour of Champaign, where a site near St. Joseph strongly appealed to the members. The government is said to be considering the buying or leasing of a tract of land of 640 acres, and it is said a force of 1,500 men would be put to work immediately. The Danville Chamber of Commerce has taken up the matter with Congressmen Joseph Cannon in an effort to land the enterprise for Danville. It is pointed out to the congressman that the old car shops at Tilton would make a desirable shop for the manufacture of the machines and for their repair, while the new fair grounds would be well adapted for the aviation school. Also the tract of land owned by the government just north of the Soldiers' Home, would be available for the school. The aviation meet was held a few years ago at the latter place.

Danville has everything in the way of healthful surroundings and railroad facilities and would be an ideal place for the aviation home of the middle west. It is stated that a second commission will shortly visit this section of the country in an effort to decide upon a definite location.

Many Use Princeton as Center

Princeton, N. J.—Princeton may become the aviation training center of the East, with every resource of the university devoted to making our fighters.

Two hundred and fifty-eight enrolled students of flying now practicing on four planes under three instructors headed by James S. Barnes, former war correspondent and aviator, are anticipating that the Government will commandeer the Princeton flying school. If so, all airmen in the district between northern New York and Texas may be trained there.

Existing Government bases, at Esington and in other localities, are to be used for training mechanics and the auxiliary supply men, according to Mr. Barnes, who addressed the Princeton Club at 1223 Spruce Street. The actual flyers will be chosen from college men.

Every Princeton student is to be given a chance in learn aviation free, to maintain allied aeroplane supremacy. Graduates here are collecting funds to continue the work until Government inspection of the Princeton equipment is complete.

New School for Memphis?

Memphis, Tenn.—An enthusiastic meeting at the Chamber of Commerce marked the auspicious beginning of a campaign to bring a larger and permanent aviation school to Memphis. The campaign was given impetus by Senator McKellar's suggestion from Washington that Memphis had a splendid chance.

Memphis has become greatly attached to the aviators.

When it became known that the temporary school at the Driving Park, had been recalled to Ashburn Field in Illinois, a meeting was called at the Chamber of Commerce, to take the matter up with the proper officials.

Mayor Ashcroft was sent for. He attended the meeting.

Senator McKellar telegraphed that was pretty certain that a permanent school could be secured for Memphis if the city or the Chamber of Commerce could guarantee a tract of at least 640 acres of land with a half dozen or so landing places within 50 miles of Memphis. The Chamber of Commerce quickly replied that it could guarantee this.

Later Mayor Ashcroft received another telegram from the senator saying that the guarantee made it reasonably certain that Memphis would get an aviation school.

Meanwhile the Chamber of Commerce appointed a committee, composed of R. L. Jordan, W. E. Gage and C. W. Butler, to take charge of the campaign.

Personal Pars

"Beating his father to it," was the expression used by Cecil H. Braddick, of the Conway-Bogue Realty Company, when he left Denver for San Diego, where he will join the United States aviation corps. Young Braddick is the son of A. B. Braddick, of the library bureau. Cecil had said nothing to his father about offering his services to the government, and when the elder Braddick arrived one evening and saw a packed suitcase standing near the door, he wondered who was going to elope.

Cecil said his father had been bragging so much about going to Fort Riley while his three sons had been doing nothing but tend to business that he had decided he would be an aviator.

Dr. W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau, addressed the Cornell Chapter of Sigma Xi on Thursday, May 17, in Rockefeller A. The subject of his talk was "The Atmosphere and Aviation." The lecture was illustrated.

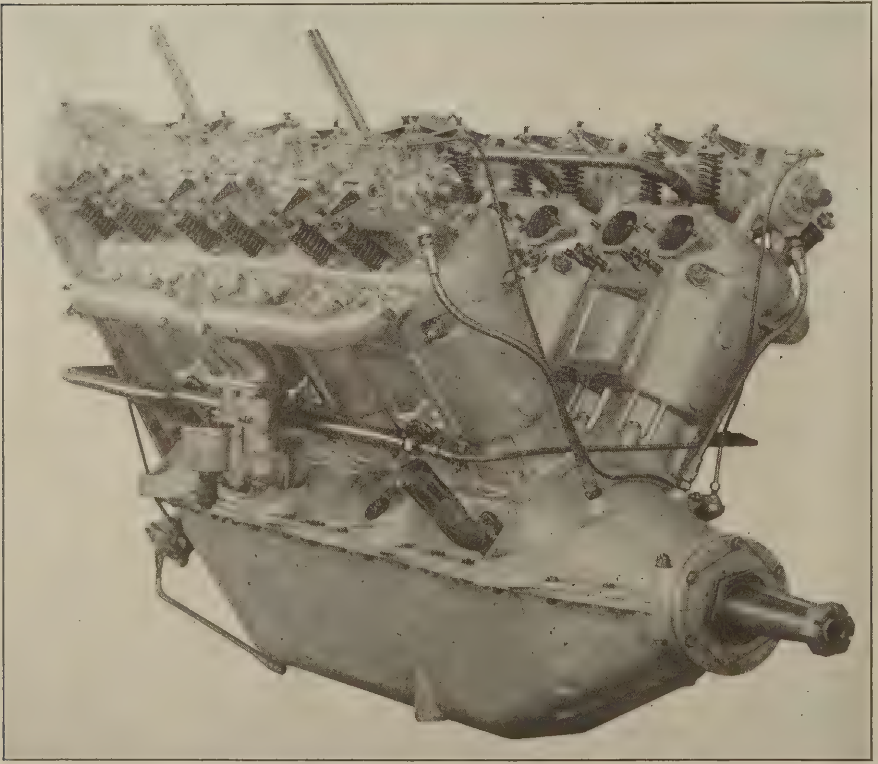
De Lloyd Thompson, the well known aviator, will soon give a series of exhibition flights in Wheeling, West Va. Although Mr. Thompson has not fully recovered from his accident sustained last fall, it is said that he is able to fly with all his old ability.

Aviation Training Near Dayton

Dayton, Ohio, May 21.—The United States Government has leased 2500 acres of farm land north of this city for an aviation training school. It will be a four-squadron school, the largest in the world. The Wright aeroplane school, organization of which was recently announced in AERIAL AGE, will assist in giving flying lessons.

To Develop Aeroplane Mechanics

Detroit, May 24.—The Government has asked all automobile factories for the names of their most expert mechanics. About 100 will be sent to France to gain experience in aeroplane construction and later will return to develop this work here.



The Wisconsin Twelve. Described on page 388 of this issue.

Northampton Aero Club Organized

Bethlehem, Pa.—The Northampton County Aero Club has been permanently organized with these members: Charles T. Hess and Harold T. Magee, Bethlehem; Howard Riegel, Henry McKeen, Henry Chidsey, George R. Elder, Sr., C. Norvin Rinck, H. W. Zook, W. Evan Chipman, R. B. Bridge, Charles M. Laubach, T. A. H. Hay, George M. Shook and R. K. Broadwee, Easton; F. B. Franks, Bath; Willis A. Flory and Thomas J. Kichline, Bangor; Dr. Howard Ott, Portland; John A. Miller and William H. Milchsach, of Nazareth. George M. Shook was elected secretary and Charles T. Hess treasurer. T. A. H. Hay is the president.

Technology Man Has Wireless Invention

Marlboro.—Dr. O. H. Stevens of this city declares that his son, Louis W. Stevens, a graduate of the Massachusetts Institute of Technology, has invented devices which, when attached to wireless telephone instruments, will make it possible for aviators to communicate with each other or with persons on the ground while they are high in the air.

He gave but few details concerning the devices. The most difficult problem to solve in the instruments that would make it possible for aviators to talk with each other, he said, was to overcome the noise made by the whirring of the aeroplane propellers and the "chugging" of the motors.

Personal Paragraphs

Roy F. Mitchell and H. J. Wells will train the members of the Kansas City Minute Men's Aero Squadron. A Curtiss military tractor will be used.

John N. Willys, of the Willys-Overland Co., was recently appointed a director in the Curtiss Aeroplane & Motor Co.

Anti-Aircraft Force to Protect New York City

To provide adequate protection against possible attacks of Zeppelins or enemy aeroplanes on New York the Veteran Corps of Artillery, its strength increased from forty-six members to seven hundred within two months, is drilling regularly and receiving instruction similar to that given the anti-aircraft fighters of Paris and London soon after the war began.

The corps is endeavoring to raise by its own efforts a sum of $100,000, which will be expended in the purchase of mobile batteries of rapid fire guns. Batteries will be stationed in Manhattan, Brooklyn, Queens and Richmond.

The Veteran Corps of Artillery was organized in 1790, and for many years has occupied an unusual position in the State militia, membership being accorded to those veterans who had achieved merit. While the corps is not upon the same military standing as the National Guard, its efforts to protect New York City against air raids will be official. In fact, when the National Guard is called from the city the Veteran Corps may represent the largest unit intact in the city and its services may therefore be used in other ways than as anti-aircraft fighters.

Following the informal announcement by the corps that it would be used for anti-aircraft fighting a membership campaign was begun and the corps of forty-six members two months ago now numbers seven hundred.

Among the members of the corps have been many who were commissioned officers of high rank in the army and navy as well as in the National Guard of various States. Major General Frederick D. Grant was a member until his death, and his son is now a member.

Naval Camp Officially Opened

Boston.—The naval aero station at Squantum was opened May 11, when the property was turned over to the United States Government by Acting Adjutant General E. Leroy Sweetser, representing Governor McCall. Captain William R. Rush, commandant of the First Naval District, received the camp in behalf of the Navy Department. "Colors" were run up while the marine band played.

Captain Rush then issued orders for the conduct of the camp in compliance with orders received from Washington to assume control of the camp, which is officially designated as "Naval Air Station, Squantum, Mass."

Lieutenant E. W. Spencer, Jr., U. S. N., has been detached from the Pensacola Aero Station and ordered to report for duty at the camp, and will be in charge. Lieutenant Spencer has not yet arrived and meantime Lieutenant Edward G. Blakeslee, U. S. N., will be in charge.

Twenty students will be given instruction at the camp and twelve mechanics will be on duty there. Assistant Paymaster Turner is the supply and commissary officer of the camp and he will have two civilian ensigns as assistants, G. Richard Fearing, Jr., and R. D. Thomas, both of the Reserve Corps.

INSURANCE FOR AVIATORS

The National Advisory Committee for Aeronautics has endeavored to interest a number of life and accident insurance companies in the subject of insurance for aviators. At first, only the more prominent companies were approached on the matter. The committee will endeavor to interest all the companies in the United States as far as practicable, and if favorable responses are received, a further bulletin will be issued on this subject.

The following is a digest of the propositions that have so far been submitted to the committee by such companies as have already expressed a willingness to insure aviators:

Aetna Life Insurance Company. Issues a war permit covering military service in the United States without charge, and beyond the United States for a charge of $50 per thousand. This includes incidental aviation but company does not care to insure men who are to make a business of aviation and who are not in the military service of the United States. Company desires to place as little restriction upon enlistment and army service as practicable, and consequently, for the present, is carrying the risk of aviation along with army service. Limit of amount which will be written upon army officers and men is $5,000 on commissioned officers, $3,000 on non-commissioned officers, and $2,000 on enlisted men.

Home Life Insurance Company. Will accept mechanics and others engaged in the manufacture of aeroplanes and allied work at standard rates. Considering the question of insuring aviators.

John Hancock Mutual Life Insurance Company. This company has agreed to certain recommendations made by a joint conference of a selected committee of the Insurance Commissioners of the several States and of the officers of the insurance companies, in regard to war conditions. The extra annual premium for the war hazard has been set for the present at $37.50 per $1,000 of insurance. This is a uniform rate and applies to service here as well as abroad or to flying over the water. The company reserves the right to charge an additional premium or to increase the present one whenever circumstances seem to call for such action. This company will accept army aviators for $1,000, and those in the aviation service who are prohibited from serving as aviators or from flying in any capacity, whether as testers, demonstrators or instructors, for the sum of $2,000 to and including ratable age 25. At ages 26 to 35 inclusive, the company will accept on those in the service, other than on those who fly, the sum of $5,000 maximum, provided they are single men with dependents, or are married men. To such as are single without dependents the limit is $2,000. The company will, of course, require suitable evidence that a person in the aviation service is not eligible to serve as a flier, either as pilot, passenger or in any other way, before it can issue more than $1,000.

Mutual Life Insurance Company of New York. "Regarding men who are employed in connection with aviation, but do not go into the air in flying machines, we do or we do not insure such men, according to the circumstances of each case. In some cases, we may think that there is a fair chance of the man in question becoming an aviator, and in such a case we would not issue a policy. If we considered that there wer no chance of his becoming an aviator, then we would probably issue him insurance."

National Life Insurance Company. Men who are employed in connection with aviation, but who do not go into the air, considered on Ordinary policies.

New York Life Insurance Company. Aeronauts, aviators, and men engaged in the manufacture of aeronautic devices, who occasionally fly, provided they do not give exhibitions and do not undertake trick flying, will be considered for a maximum amount of $2,000 with an annual extra premium of $25 per thousand, together with a war clause. The extra premium will be eliminated from the policy one year after they have given up flying either as an occupation or as a pastime, subject to evidence of insurability satisfactory to the company. A refund will be made of the extra premium paid during that year.

The war clause provides for a single extra premium of $100 a thousand in event of engaging within two years from the date of issue in any Military, Naval, Red Cross or other relief service outside the boundaries of continental United States. (The boundaries of continental United States are defined to include the waters within three miles of the coast line, but do not include the Panama Canal Zone.) If the insured does not pay the extra premium, and dies within the first two years from date of issue of the policy as the result, directly or indirectly, of engaging in the service already mentioned, the insurance is limited to one-fifth of the face of the policy.

The foregoing provisions would not apply to persons who are in the service of, or who volunteer for service with, a foreign power.

This company does not issue to persons in hazardous occupations the so-called disability benefits or double indemnity benefits.

The Northwestern Mutual Life Insurance Company. "This company does not insure aviators or persons known to contemplate aviation or likely to engage therein. We do not, however, as to our war service regulations, make any distinction by way of discriminating against those persons who, having entered military or naval service, are attached to the Signal Service branch and engage in aviation." Policies issued prior to April 10, 1917, are entirely free of restriction, but in the case of policies issued subsequently, there is a military or naval service provision, the conditions of which are avoidable only upon payment of such extra premium as the company may require. The extra rate has been fixed temporarily at $50 per thousand, and the same flat rate holds regardless of the branch of service or place of service."

The Prudential Insurance Company of America. "We are prepared to consider applications for insurance from aeronauts on the basis of what is known in this company as 'Hazardous Ratings.'

"This would mean an extra premium rate on Whole Life policies varying from about $8 at the youngest ages to $13 at age of 40; on Twenty-Payment Life policies an extra premium of about $10 at the youngest ages and about $13 at age 40; and on Twenty-Year Endowments an extra premium of between $4 and $5 at the youngest ages and about $8 at age 40.

"As an illustration of the gross premium including the extra, the Whole Life rate at age 25 would be $25.58 per $1,000 of insurance; the Twenty-Payment Life rate, $34.42; and the Twenty-Year Endowment rate, $46.50.

"Such policies would be limited in amount to $2,000 and would contain the company's regular war clause, which provides for an extra premium of $100 a thousand for service in the Navy, and an extra premium of $100 a thousand for service in the Army outside of the United States as constituted before the year 1898. The extra premium on account of occupation would be included as a part of the $100 extra premium; in other words, the gross premium would never exceed the company's standard premium rate plus the extra premium on account of war. No extra premium would be charged for military service within the United States."

"Will not insure aviators not actually in or who do not intend to be in the Government service.

The Travelers' Insurance Company. Will insure aviators attached to the Army or Navy on the same terms as members of any expeditionary force sent abroad. Will not issue accident insurance, but will issue life insurance on the Ordinary or higher premium life forms with an additional premium of 10 per cent of the amount of insurance per annum. The amount of insurance is limited to $1,000 an individual.

Union Central Life Insurance Company. Policy holders subsequently employed as aviators or in connection with aviation will be placed upon the same basis as those entering the Army and Navy.

Accident Insurance for Aviators

No definite proposition has yet been submitted to the committee on the subject of accident insurance for aviators.

The North American Accident Insurance Company is making an investigation of the subject and will take the matter up with other accident insurance companies, with the idea of establishing a uniform policy.

The New Amsterdam Casualty Company is endeavoring to bring about the formation of a pool of accident insurance companies, and is willing to take its pro-rata share of the business.

ARMY AND NAVY NEWS

Applications are being received from thousands who wish to join the Reserve Flying Corps, more than 800 names being registered in Boston alone. The applicants include college men, motor salesmen, mechanics, chauffeurs and men who are interested in racing cars and speedboats. The number of names sent in has enabled the officers in charge to secure a picked lot of men for the first quota, most of which already is in training. Several new training camps are being established and the men will be sent as rapidly as accommodations are assured.

Brig. Gen. George O. Squier, C.S.O., U.S.A., has written a letter to Frank H. Bethell, vice-president of the New York Telephone Company, of New York City, in which General Squier says that telephone employees can best serve the Government by remaining at their posts and continuing to give efficient service. "In the conduct of the war that is upon us," writes General Squier, "the service furnished by your company and by all telephone companies will be of the greatest importance. You will be called upon to meet demands of the most urgent kind. You have been called upon, and you may be called upon further, to furnish men trained in the art of constructing and maintaining telegraph and telephone lines."

The Aero Squadron Aviation School and the aviation field, located south of San Antonio, are detached from Fort Sam Houston and made an independent command, according to a memorandum issued from Southern Department headquarters at Fort Sam Houston. The new command is designated Aviation Camp, San Antonio, and it has been directed that all mail, etc., be sent there, as it will henceforth be considered a unit separated from the local Army post.

Major William Mitchell, Aviation Section, examination, original vacancy, to be Lieutenant Colonel with rank from May 15, 1917.

Major Charles S. Wallace, examination, vice Mitchell, detail in Aviation Section continued, to be Lieutenant Colonel with rank from May 15, 1917.

Captain Arthur S. Cowan, original vacancy, to be Major with rank from May 15, 1917.

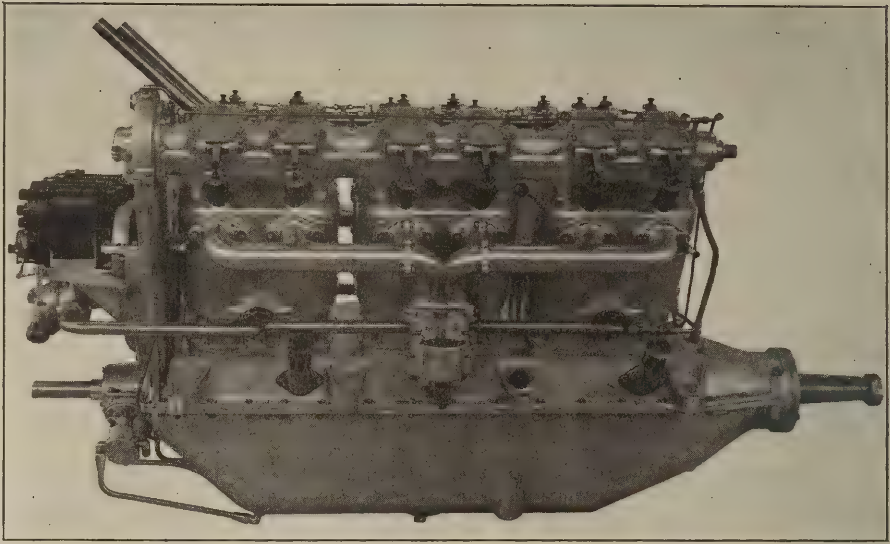
First Lieut. Carlyle H. Wash, 6th Cav., to Fort Bliss, Tex., for examination of physical qualification for detail in Aviation Section, S.C.

Private Arthur E. Brown, Signal Corps, Fort Slocum, N. Y., will be sent to Mineola, Long Island, N. Y., for duty at the Signal Corps Aviation School.

Capt. Joseph C. Morrow, Jr., junior military aviator, Signal Corps, is designated as aeronautical officer of the Central Department.

Lawrence Leon's class at one of the aviation training grounds.

WISCONSIN "TWELVE" AVIATION ENGINE



THE Twelve-Cylinder Wisconsin Aviation Engine recently went through its preliminary tests very satisfactorily.

The engine is of the "V" type, with cylinders in pairs and valves in head.

The cylinders are made of aluminum alloy castings, are bored and machined and then fitted with hardened steel sleeves about 1/16" in thickness. After these sleeves have been shrunk into the cylinders, the sleeves are finished by grinding in place. Gray iron valve seats are cast into the cylinders. The valve seats and cylinders, as well as the valve ports, are entirely surrounded by water jackets. The valves set in the heads at an angle of 25° from the vertical are made of Rich Tungsten Steel, and are provided with double springs, the outer or main spring and the inner or auxiliary spring, which is used as a precautionary measure to prevent a valve falling onto the cylinder in the remote case of a main spring breaking.

The cam shaft is made of one solid forging, case hardened. It is carried in an aluminum housing bolted to the top of the cylinders. This housing is split horizontally, the upper half carrying the chrome vanadium steel rocker levers. The lower half has an oil return through cast integral, into which the excess oil overflows and then drains back to the crank case. Small inspection plates are fitted over the cams and inner ends of the cam rocker levers. The cam shaft runs in bronze bearings and the drive is through spur gears.

The crank case is made of aluminum, the upper half carrying the bearings for the crank shaft. The lower half carries the oil sump in which all of the oil except that circulating through the system at the time is carried.

The crank shaft is made of chrome vanadium steel of an elastic limit of 115,000 lbs. The crank pins and ends of the shaft are drilled for lightness and the cheeks are also drilled for oil circulation. The crank shaft runs in bronze backed, Fahrig metal lined bearings, four in number. A double thrust bearing is also provided, so that the motor may be used either in a tractor or pusher type of machine. Outside of the thrust bearing an annular ball bearing is used to take the radial load of propeller. The propeller is mounted on a taper. At the opposite end of the shaft a bevel gear is fitted which drives the cam shaft, through a vertical shaft, and also drives the water and oil pumps and magnetos. All gears are made of chrome vanadium steel, heat treated.

The connecting rods are tubular and machined from chrome vanadium steel forgings. Oil tubes are fitted to the rods which carry the oil up to the wrist pins and pistons. The rods complete with bushings weigh 5½ pounds each.

The pistons are made of aluminum alloy and are very light and strong, weighing only 2 lbs. 2 oz. each. Two leak proof rings are fitted to each piston. The wrist pins are hollow, of hardened steel, and are free to turn either in the piston or the rod.

A bronze bushing is fitted in the upper end of the rod, but no bushing is fitted in the pistons, the hardened steel wrist pins making an excellent bearing in the aluminum alloy.

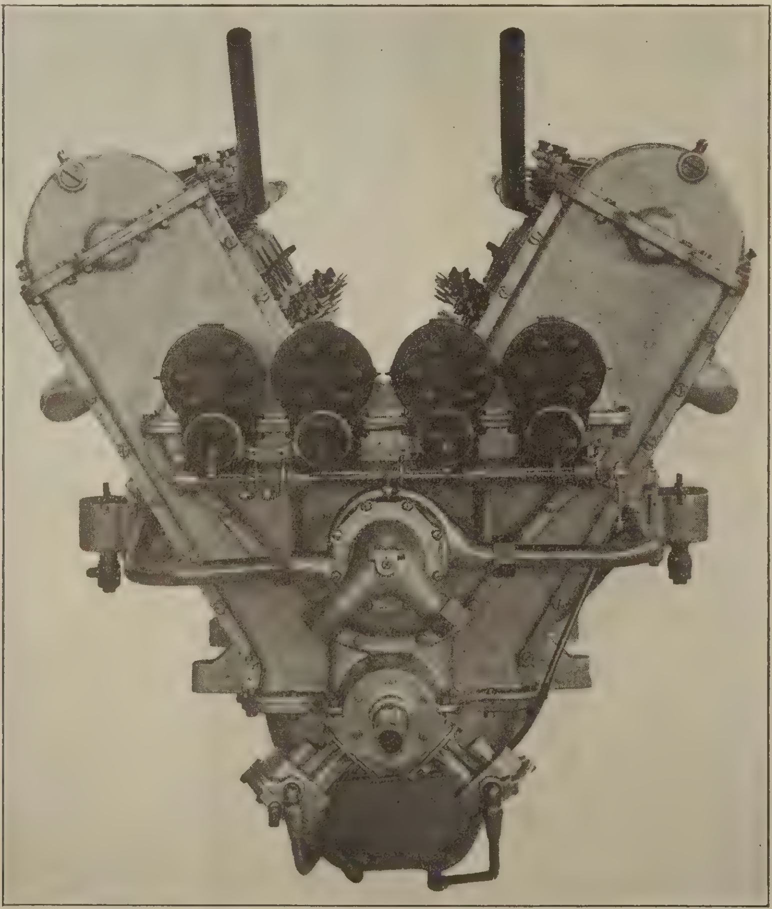
The water circulation is by double centrifugal pump. The water is pumped through brass pipes to the lower end of the cylinder water jackets and leaves the upper end of the jackets just above the exhaust valves.

The lubricating system is one of the main features of the engines, being designed to work with the motor at any angle. The oil is carried in the sump, from where it is taken by the oil circulating pump through a strainer and forced through a header, extending the full length of the crank case, and distributed to the main bearings. From the main bearings it is forced through the hollow crank shaft to the connecting rod big ends and then through tubes on the rods to wrist pins and pistons. Another lead takes oil from the main header to the cam shaft bearings. The oil forced out of the ends of the cam shaft bearings fills pockets under the cams and in the cam rocker levers. The excess flows back through pipes and through the train of gears to the crank case. A strainer is fitted at each end of the crank case, through which the oil is drawn by separate pumps and returned to the sump. Either one of these pumps is large enough to take care of all of the return oil, so that the operation is perfect whether the motor is inclined up or down. No splash is used in the crank case, the system being full force feed. An oil level indicator is provided showing the amount of oil in the sump at all times. The oil pressure in these motors is carried at ten pounds, a relief valve being fitted to hold the pressure constant.

Ignition is by four Bosch magnetos, two for each set of cylinders.

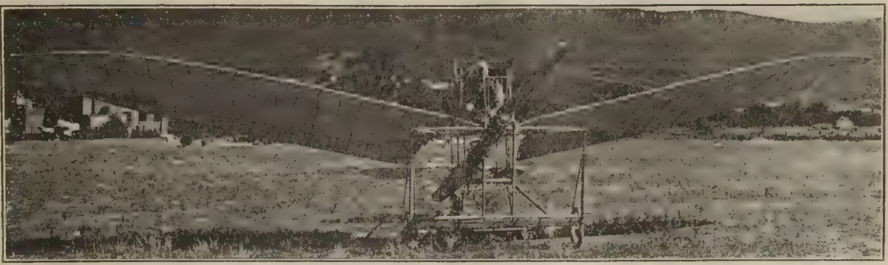
Two Zenith double carburetors are used, three cylinders being supplied by each carburetor. This insures a higher volumetric efficiency, which means more power, as there is no overlapping of inlet valves whatever by this arrangement.

All parts of these motors are very accessible. The water and oil pumps, carburetors, magnetos, oil strainer or other parts can be removed without disturbing other parts. The lower crank case can be removed for inspection or adjustment of bearings, as the crank shaft and bearing caps are carried by the upper half. The motor supporting lugs are also part of the upper crank case.



The Magneto End of the Wisconsin Twelve

THE DUNTON MONOPLANE



THE Dunton monoplane is designed to maintain lateral stability and to be easily controlled. It is built to the designs of Mr. O. L. Dunton of North Adams, Mass.

The main planes extend from the body outward and upward. The entering edge is perfectly straight as the whole under surface of the plane is flat except a slight downward curvature at the rear edge and outer ends. The main bar of the plane is forward of the center extending from the tip of the wing or plane through the inner edge, where it is covered by a steel sleeve and securely fastened to the frame by a ball and socket joint.

To provide for the stability and free movement of the planes, trusses are securely bolted to either side of the frame and extend a suitable distance above and below to receive guy wires for holding the planes in position. The top and bottom of the trusses are connected together by a reinforced steel tube and securely stayed in position by steel cables and turnbuckles.

The guy wires on the main bar are fastened to the top and bottom of the trusses and the wires on the rear edge of the planes are fastened to the trusses through pivoted arms in relation to the wires on the main bar and connected up in the following manner:

These pivoted arms are fastened to the top and bottom of either truss, allowing their outer ends free to move through the arc of a circle. The arms on top of the trusses are set to point forward and a little out to bring them at right angles to the center guy wire on the rear edge of the plane. The arms on the bottom of the trusses are set pointing back and a little in to bring them at right angles to the center guy wire at the rear edge of the plane underneath. The ends of the upper arms are connected together by cable and turnbuckles to take up strain, the lower ones the same.

This movement of the planes is provided to take care of the air currents or different air pressure under the planes. For instance, if an air current is greater under the right-hand plane it will move back, the rear edge will move up, giving a lesser angle incident to the line of flight while the opposite plane will move in an opposite direction with a corresponding greater angle incident to the line of flight, it being understood these movements being governed entirely by the varying air currents.

This movement in a trial flight and still atmosphere was very slight, hardly percepitble, while in a high and gusty wind it is still to be demonstrated.

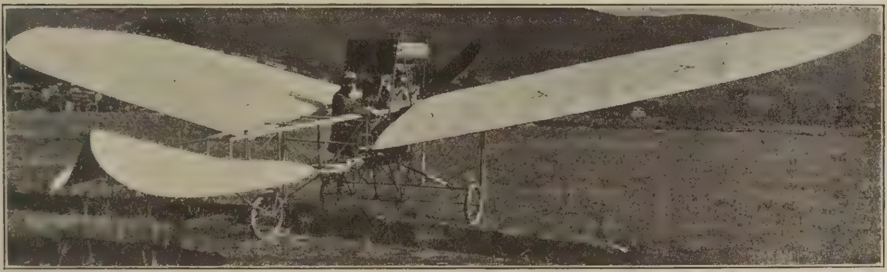
The steering to the right or left is very simple. By moving the pivoted arms the angle is changed on the main planes incident to the line of flight without in any way interfering with the movement caused by air currents. To accomplish this movement a fork-bearing is securing to the lower truss bar and free to move forward and back, secured from side motion by lugs welded to the bar.

A four grooved sheave is fastened to the steering post which passes through the bearing and up through the floor and provided with a steering wheel. A wire cable is fastened to the end of one of the pivoted arms at the bottom and carried around the groove sheave and made fast. In like manner another cable is fastened to the opposite pivoted arm and carried around the groove sheave in an opposite direction, so when the steering wheel is turned it will wind up one cable, pulling the arm in and unwinding the other, letting it out, which causes the rear edge of one plane to lower and the other to rise.

The wires on the rear edge being pulled down for deflecting the plane also pull in and tend to pull the plane back, which is the natural way for turning and causes the plane to properly bank. The guy wires at the rear inner edges are connected to the outer ends of the pivoted arms, and the center and outer guys wires at the rear are connected about two-thirds out. This is to keep the planes from warping when moved, due to a little angular effect. Each guy wire fastened to the truss or pivoted arm is in a direct line through the ball and socket joint on the main bar, to its corresponding wire so as not to tighten or loosen the wires when the planes are moved.

The rear edges of the planes are connected by a steel tube carrying long right and left hand threads and secured at the rear inner edges by a suitable joint to allow free movement. This provides for the backward thrust and also gives a wide range of adjustment to the planes for finding the center of gravity. Adjustable tension springs are fastened to the forward inner edge of the planes and secured to the frame to keep the planes in a central position or bring them back when moved by air currents. They also help take care of the backward thrust.

These pivoted arms accomplish two things: first, the wires at the rear edge of the planes being connected to them, when if they are moved through the arc of a circle, the rear edge of the planes is raised and lowered; i. e., when one is raised the opposite plane is lowered. This is done by the steering wheel, as described later. Second, the guy wires on the pivoted arms and the main ones on the trusses being at different points cause the rear edge to rise and fall as the plane is moved back and forth; namely, the rear edge is deflected down when the plane is moved front or gives a greater angle incident to the line of flight; the opposite takes place when the plane moves back and the opposite plane being connected by the rear bar is moved in an opposite direction.



The steering up or down is done wholly by the rear plane or tail and is hinged to a horizontal bar fastened to the rear end of the frame, said tail or plane being free to move up and down and controlled by cables fastened to the plane and passing to spreaders at the inner edge, thence to a rocker arm which is connected to the steering post.

The center of the rear plane or tail is carried up to a "V" point that when in flight and occupying a neutral position, part of both upper and under surfaces will be slightly active. This causes a slight drag which gives a good steadying effect and is very sensitive to change the altitude when moved by the steering wheel. If the plane should become stalled when in flight the "V" form of the tail is such as to stop any tendency to fall backward.

TESTS OF AN ADJUSTABLE PITCH PROPELLER

BEFORE a party of aeronautical experts, including E. L. Graham, official inspector for the U. S. Government, stationed at the Wright-Martin factory in Los Angeles, a series of tests were made of a new type of propeller with an adjustable pitch. It is the invention of Robert I. Eustis and Seth Hart, who superintended the tests which were made at Long Beach, Cal.

The main part of the invention lies in an adjustment in a steel propeller hub by which the pitch of the blades may be increased or diminished at the will of the pilot, while the machine is in full flight, and the motor wide open. Earl S. Dougherty tried out the propeller in flights at Long Beach. Dougherty remarked that there was less vibration to the machine and smoother working of the engine when this new propeller was installed than when the ordinary fixed-pitch propeller is used. The steel hub has the action of a flywheel, tending to eliminate vibration.

The hub is equipped with a self-locking device which cannot be affected in any manner other than by the control of the pilot. The pitch is unaffected by vibration or air pressure after adjustment and the change in pitch is so delicate that it can be changed to a micrometric adjustment. On a block test with 60 Hall-Scott motor, the propeller showed results as follows:

4′ 8″ Pitch, 1050 r.p.m., 400 Lbs. Thrust
5′ 6″ Pitch, 1025 r.p.m., 360 Lbs. Thrust
7′ 2″ Pitch, 1000 r.p.m., 300 Lbs. Thrust

Further and more exacting tests are to be made of the propeller. Dougherty has just opened a school of aviation, and has a number of pupils taking instruction, but it is expected that he will continue the propeller tests.

The Eustis-Hart Adjustable Pitch Propeller Being Tested on the Dougherty Tractor

EXPERIMENTAL RESEARCHES ON THE RESISTANCE OF AIR

By L. MARCHIS

(*Concluded from page* 300)

4. The Laboratory of M. de Guiche

M. de Guiche has instituted a systematic series of experiments by the method of displacing the body under investigation in quiet air.

The body (use so far has been made of plates in various forms) is carried by an automobile. Two vertical pillars fixed to the machine carry at their upper extremities a horizontal axis on which are placed the various plates under investigation. These plates are provided at their lateral extremities with two graduated half circles, which, by means of a needle carried by each pillar, serve to measure their inclination relative to the line of movement. The pillars are of sufficient height and so placed that the turbulence produced by the automobile itself is not felt in their neighborhood. In particular, M. de Guiche has found it advantageous to carry the mounting on the rear of the automobile rather than on the front. The wheels and the body throughout are, furthermore, suitably shielded in order to diminish turbulence.

M. de Guiche thus carries out a sort of topographical measure of the pressures exerted on the different points of the plates both on the front and rear sides.

As we have seen previously, M. Eiffel likewise employs this method, but he determines separately the pressures at the different holes and measures each time the velocity of the current of air by means of a Pitot tube. As this velocity is somewhat variable, the pressures are reduced to what they would be if the velocity were constantly equal to 10 meters (32.8 feet) per second.

But in operating this by successive observations there is danger of finding between the determinations marked discordance.

Therefore, M. de Guiche determines at the same time, and by a single experiment, the pressures at selected points in as large a number as possible. To this end the plates which are to serve for the experiment are pierced, each with holes forming two series of lines cutting each other at right angles (for planes, lines at the maximum slope and horizontal lines). In a single experiment, and at the same instant, the pressures in all these points of the several lines are measured.

To this end, 20 orifices ending at these holes on the various lines are provided with 20 rubber tubes connecting them with 20 little manometers. These manometers are mounted side by side in a frame before a glass provided with transverse divisions in half millimeters.

The indications of all these manometers are inscribed at any given instant by placing them in a photographic chamber where the atmospheric pressure acts upon their open ends. By lighting the interior of the chamber with electric lamps, there is readily produced on a photographic plate the levels of the liquid in the different manometers.

It may be asked if the pressure of the atmosphere actually prevails in the interior of the photographic chamber. The latter can not, in effect, be perfectly tight, if it is not desired that it should operate as an air thermometer. It is then possible that during the movement of the automobile, currents of air passing through small apertures of the photographic chamber may tend to produce a variation of pressure within. M. de Guiche has assured himself by many experiments that this effect is entirely absent and that atmospheric pressure prevails throughout the interior of the photographic chamber.

At the Institute of Saint-Cyr, M. Maurain, who has employed the manometric method, undertook to establish in spite of the perturbations caused by the movement of the vehicle, the atmospheric pressure on the open part of the manometers which he uses for measuring pressure. To this end the open part is connected to a space, completely tight, which communicates with the outside air by means of a tube placed at the extremity of an antenna. The latter is placed quite far from the surface in order to escape variations of pressure which are produced in its vicinity (2.3 meters, 7.54 feet) in front of the surface under investigation and 3.35 meters (10.9 feet) above the body of the car. At the extremity of this antenna is a tube of which the useful part is horizontal and cylindrical and is terminated by a pointed closed cone pointing in the direction of movement. In the cylindrical and lateral part of the tube are formed small circular openings of 1 millimeter (0.04 inch) in diameter which place it in communication with the atmosphere. M. Maurain has assured himself that this tube placed in a current of air of 20 meters (65.6 feet) per second approximately parallel to the current assumes indeed the pressure of the atmosphere.

The pressures thus determined directly are reduced to the values which they would have at a velocity of 10 meters (32.8 feet) per second. Curves of equal pressure may then be traced, thus indicating the condition of the surface of the body and showing the distribution of pressure over the same.

Furthermore, the surface of the body is divided into strips of a certain width. By a calculation of averages, the mean pressure is determined for each strip. Multiplying this by the surface of each strip, we have the resistance exerted by the air on the given strip. As the surface of the body under investigation is perfectly smooth, the friction of the air on such surface may be neglected. The force determined is then normal to the surface of the body. By combining these forces by the well-known methods of graphical statics, the resistance of the air over the entire plate may be obtained in magnitude and location.

Finally, in the experiments of M. de Guiche the automobile should move through a mass of air motionless as a whole. To this end the experiments are made at certain hours on favorable days over a road traversing a forest. The road is about 30 meters (98.4 feet) wide and is bordered with small brush. The straight part in which the measures are taken is determined at its two ends by easy turns. There is thus avoided the establishment of a regular current of air along the axis of the road.

The velocity of the automobile relative to the ground is measured, correcting it, if necessary, for the component of the wind along the direction of motion.

5. The Laboratory of Chalais-Meudon and the Experiments of M. le Commandant Dorand

The aerotechnic laboratory of Chalais-Meudon is celebrated throughout the entire world by reason of the work of Col. Charles Renard. It is there that were made the studies which have brought the solution of the problem of the dirigibility of balloons. It is there that have been established by precision experiments some of the fundamental laws of air resistance. It is there, finally, that were made certain experiments by Capt. Ferber, experiments which should soon lead to the French solution of the problem of aviation.

M. le Commandant Dorand has brilliantly continued the labors of these eminent predecessors. The experiments made here on air propellers have carried a long step forward this complex question.

They were made on propellers of normal size by means of the car method, which was later applied at the Institute of Saint-Cyr.

The propeller to be tested is mounted on a car moving on a railroad. This car carries a dynamo shunt excited, by means of which the propeller is turned at a constant speed. On the same car are placed registering apparatus for thrust, speed of car, speed of rotation, and power absorbed.

The railroad, of 1 meter gauge (3.28 feet), on which moves the dynamometer car, has for half of its length a uniform grade. It is prolonged by a level run and then by an ascent, destined to diminish the velocity of the car before application of the automatic brakes. There is utilized in this manner the weight of the equipment, the effect of which added to the propulsive effort of the propeller gives rapidly to the vehicle a high velocity, and brings it back to the point of departure after the experiment. The current intended for the electric motor is brought by two insulated rails, on which move sliding shoes of bronze similar to those which are used for electric railroads.

In order to obtain a constant electric resistance in the circuit, no matter where the car may be on the track, the current is brought to the rails at two opposite extremities. By this means the instruments for the measuring of electric quantities may be located at a fixed point and not on the vehicle.

The energy is transmitted to the propeller shaft by means of a chain.

In order to measure the tractive pull of the propeller there is carried at the end of the propeller shaft (turning in roller bearings) a roller thrust bearing which transmits the tractive effort to a manometric cell. A registering dynamometer thus gives at each instant the thrust of the propeller.

The power absorbed by the propeller is obtained by means of indications furnished by an ammeter and a voltmeter of the recording type, previously standardized for the different speeds of the motor by the aid of a Renard brake.

Chronographs indicating the origin of time are mounted on each of the registering equipments and are put in movement automatically at the same moment.

The part of the apparatus provided for the measuring of the propeller thrust is movable relative to the car. It results that the tractive effort directly measured represents the algebraic sum of the following forces:

(*a*) Tractive effort on the level;

(*b*) $+ph$, p being the weight of the moving system and h the change of level per meter run;

(*c*) Inertia $= -\dfrac{p}{g}\dfrac{dv}{dt}$, g being the acceleration due to gravity, and $\dfrac{dv}{dt}$ the acceleration of the motion of the car.

The tractive effort on the level, which interests us here, is then equal to the tractive effort measured directly, diminished by ph and augmented by $\dfrac{p}{g}\dfrac{dv}{dt}$. For an acceleration which remains near 0.8 meter second (2.6 feet per sec.), this last correction is

$$p \times \frac{0.8}{9.81} = 0.0815\,p$$

As p is always less than 60 kilograms (132 pounds), this correction is about 5 kilograms (11 pounds).

The maximum speed of the dynamometer car has been, in these experiments, equal to 14.6 meters (47.9 feet) per second.

M. le Commandant Dorand made, at the military aerodrome of Villacoublay, numerous trials with a biplane of his construction, and piloted by Labouchère.

This flying laboratory is a biplane with planes stepped toward the front; it is provided with an engine of 60 horsepower, with tractor propeller.

During a horizontal flight the following measures were made:

(*a*) Thrust of the propeller.
(*b*) Speed of rotation of the propeller shaft or of the engine.
(*c*) Speed of the aeroplane relative to the air.
(*d*) Angle of incidence of the planes.

The measures are instantaneous. At the desired moment in horizontal flight the pilot presses on a button and thus determines the registration of all the measures to be made.

The frame of the engine is mounted in a dynamometer balance on a shaft carried on roller bearings. The moment of the thrust of the propeller relative to this axis is balanced by that of two hydraulic cells. Recording manometers give the pressure at the cells and thus furnish, through the lever relation, the thrust of the screw itself. The recording drums are set in motion at the instant of start of the aeroplane; chronograph markers moved electrically indicate on each sheet the precise place where the reading is to be made.

The action of the air on that part of the balance comprising the engine and its supports gives rise to a force which must be added to that which is measured, if it is desired to know the true thrust of the propeller. In order to make this correction, the entire system without the propeller is placed in a current of air. The velocity of this is measured as well as the resistance which it develops.

The measure of the thrust of the propeller gives the resistance of the aeroplane at any given instant of its horizontal flight.

In order to measure the speed of rotation of the engine, there is mounted on the shaft a cylinder of ebonite covered over half its circumference with a sheet of copper. Two brushes installed in the circuit of an electric chronograph rest on this cylinder. At each revolution of the engine there is an interruption of the current and hence a jog on the chronograph sheet.

The measure of the relative velocity through the air is made by means of a Venturi tube. We may note here that the operation of this apparatus has been made at the Aerotechnic Institute of Saint-Cyr, the subject of a very careful and systematic investigation.

The angle of incidence is obtained by means of a clinometer formed by a pendulum dampened in glycerine. A pointer which moves over a scale indicates at each instant the angle of the chord of the planes with the horizon.

Experiments in gliding flight have also been made with this equipment. They require the knowledge of the gradient of the path during the glide, or the angle of the relative air movement with the horizon. This item is furnished by means of a vane with horizontal axis.

Reprinted from the Second Annual Report of the National Advisory Committee on Aeronautics

6. The Aviation Laboratory of Vincennes and the Experiments of Capt. Olive

The ministry of war has instituted, under the charge of the artillery school at Vincennes, a laboratory which is specially concerned with researches in aviation.

Among the investigations carried out in this laboratory, we should note here the measurements made by Capt. Olive on aeroplanes of normal dimensions. The principle of the method was as follows:

Let us consider a body rigidly suspended from a trolley which rides on a rectilinear inclined cable. Let us assume that the body possesses a plane of symmetry which also contains the cable. The body under investigation, descending along the cable in such manner that its plane of symmetry is displaced parallel to itself, is subjected, at each instant, to the following forces:

(1) The action of gravity applied at the center of gravity.

(2) The resistance of the air applied at a point which we may designate by ρ.

(3) The force of inertia applied at the center of gravity.

These forces may be decomposed parallel and perpendicular to the cable. The components of the weight are opposed to those of the resistance of the air; those of the force of inertia are parallel to them.

Graphic record is made of the magnitude of the components parallel and perpendicular to the cable. When the system is in a state of rest, the weight acts alone. The mode of recording thus provides for the elimination of the effects due to gravity.

The body under investigation is allowed to descend along the cable, with the trolley, to which it is rigidly attached. At a given moment the acceleration, α, of the system is measured and record is made of the components of the resistance of the air and of the force of inertia.

The acceleration α is measured in the following manner: When a pendulum is mounted on a support which, itself, is given a movement of translation with an accelerated velocity, it tends to place itself at each instant in a position such that the angular deviation from the vertical is connected with the acceleration α by the equation

$$\beta = \frac{\alpha}{g}$$

The angle β is, in general, quite small. This principle has been realized in the following manner:

A car moves on an aerial monorail formed by a cable stretched between two posts. The aeroplane under investigation is suspended from this car by means of a bar to which it is attached through a network of wires forming triangles, thus giving the equivalent of a rigid connection in every direction. In order that these wires may remain under tension during the experiment, it is necessary that the weight of the aeroplane shall be greater than the upward thrust received from the air during the movement.

The bar connecting with the car is attached thereto by means which transmit separately to dynamometer springs, on the one hand, the forces normal to the cable, and, on the other, the forces parallel to the cable. The movements of the springs are recorded on a moving cylinder.

The cable on which the car rolls shows a general inclination in such manner that the movement of the apparatus may be produced by the action of gravity.

The experiment should be carried out in a part of the cable where the inclination is practically constant in order to avoid the need of taking account of the varying components of gravity and of the force of inertia produced by the curvature of the cable.

At Vincennes the cable, which is 155 meters (508 feet) long, is carried by two pillars which are installed, one on the summit of a hill of about 20 meters (65.6 feet) height, the other on the crest of an embankment. The maximum deflection of the cable varies between 1.4 meters (4.6 feet) without load to 5 meters (16.4 feet) for a load of 1,000 kilograms (2,204 pounds) placed at the center, the tension remaining constant. The general slope is 12 per cent. In the experiments the weight carried was 700 kilograms (1,543 pounds) and the maximum velocity realized was 12 meters per second (39.4 feet per second).

7. The Experiments of Commandant Lafay at the Physical Laboratory of the Polytechnic School

Commandant Lafay has installed in the physical laboratory of the Polytechnic School the apparatus previously used by M. Rateau. He has utilized this apparatus in order to solve, often in an elegant manner, a series of interesting problems in aerodynamics. For example, he has proposed to make visible the paths of air stream lines which surround solid bodies of different forms placed within a cylinder of air issuing from the discharge orifice of a fan.

The methods which give the total resistance of the air enable us generally to determine separately the lift and the drift. From these we may then find the ratio of support, which is nothing but the ratio of the lift to the drift. As a matter of fact, in a horizontal flight, the smaller this ratio, the greater the weight carried by a given effort of propulsion. If we call ϕ the angle of the lift with the total resistance, the relation of the drift to the lift is equal to tan. ϕ By reason of the importance of this angle, which Commandant Raibaud of the aviation laboratory at Vincennes proposed to call the angle of support, M. Lafay has constructed an apparatus by which it can be determined directly without going through the determinations of the lift and drift.

He has operated on different stuffed birds and has tried to determine the value of this ratio of support for these birds.

He has been brought to the conclusion that a stuffed bird behaves, on the whole, as a mediocre flyer, certainly inferior to one of our good monoplanes.

These experiments which have dealt with stuffed birds can not, with certainty, be extended to living birds. However, this result leads us to admit only with reserve the statements of those who claim that birds are perfect flyers, presenting for the angles of attack which they utilize ratios of support far superior to those of our apparatus.

M. Lafay has set himself another problem which is very important in regard to the practice of aviation.

The experiments made with models of wings or of aeroplanes are, as a general rule, exclusively static. The wind of the blowing apparatus whose action is utilized is maintained in a constant state during the period of each observation. Now, when an aeroplane moves through the air it is subject on the part of the air to actions which vary quite rapidly not only in intensity, but also in direction. Although the inertia of an aeroplane prevents it from obeying all these instantaneous forces, it may be questioned if the static experiments of the laboratory can be applied without restriction to machines in practice. M. Lafay has striven to give a few indications regarding this question. He has tried a few dynamic experiments, *i. e.*, he has tried to study the variable forces produced by a wind which changes rapidly its direction or its intensity.

The experimental study of this problem presents great difficulties, due chiefly to the disturbing actions of inertia. In order to avoid them, he was led to build models as light as possible, attached to elastic carriers, and to make use of the deformations of these carriers in order to measure the forces. But if these deformations are to be very slight, in order that the energy acquired by the system be negligible, they must, however, be sufficiently great and sufficiently regular to permit of arriving, by means of an appropriate optical amplification, at a correct evaluation of the forces which produce them. The results of this amplification must be such that they can be registered photographically on account of the rapidity of evolution in the phenomena under investigation. Finally, the model and its elastic support would not fail to take on a vibratory movement under the action of the inevitable irregularities of the blowing apparatus, except for the precaution of adding just enough dampening to make the apparatus practically aperiodic, without, however, retarding too much its dynamic indications.

M. Lafay has produced an aerodynamometer capable of satisfying these contradictory conditions.

These experiments have been interrupted by the war. However, from those which have been made it seems to be proven that for changes of speed and direction having the degree of rapidity of those which may normally take place in aviation, the resistance of the air at a given moment has a value little different (10 per cent at the most) from that which one would obtain in permanent régime, keeping invariable the conditions which characterize, at the instant under consideration, the movement of the avion relative to the air.

Consequently, we can deduce from static experiments, properly directed, the elements which are necessary for the calculation of the forces sustained by a machine in given circumstances, as, for example, those which accompany its rapid righting after a diving flight, or its entrance into an ascending or descending current of air.

8. Aerodynamic Studies Performed in Other Laboratories

A certain number of aerodynamic experiments have been made in other laboratories.

Mention may be made of the experiments on propellers at a fixed point performed by M. Auclair in the experimental laboratory of the Conservatoire des Arts et Métiers. This young savant was the first to give precise results on the influence of the back of the blades, an influence which had been noted as early as 1900 by M. Rateau.

L'Institute Marey, in the Parc des Princes, is continuing the fine studies of Marey on the flight of birds.

M. Houssaye, in his laboratory of l'Ecole Normale Supérieure, at Paris, is studying the resistance of water on the forms of fishes.

M. Magnan, in the laboratory of l'Ecole des Hautes Etudes at the Sorbonne, is trying to deduce from the study of the dimensions of birds some coefficients which will be useful for the construction of aeroplanes.

Army and Navy Orders

The following-named officers are relieved from duty with the First Aero Squadron, Signal Corps, and will proceed to the stations as hereinafter indicated:

Capt. Charles C. Benedict, junior military aviator, Signal Corps, to Urbana, Ill., for duty at the University of Illinois.

Capt. Ralph P. Cousins, junior military aviator, to Austin, Tex., for duty at the Texas State University.

Capt. Benjamin W. Mills, junior military aviator, Signal Corps, to Boston, Mass., for duty at the Massachusetts Institute of Technology.

First Lieut. Howard C. Davidson, Infantry, detached officers' list, to Ithaca, N. Y., for duty at Cornell University.

The travel directed is necessary in the military service.

The following-named officers are relieved from duty at the Signal Corps Aviation School, San Diego, Cal., and will proceed to the stations as hereinafter indicated:

First Lieut. Arnold N. Krogstad, Twenty-second Infantry, to Berkeley, Cal., for duty at the University of California.

Capt. John N. Reynolds, Coast Artillery Corps, and First Lieuts. Harry M. Brown, Twenty-second Infantry; James R. Alfonte, Infantry, detached officers' list; Michael F. Davis, Infantry; Patrick Frissell, Eleventh Infantry; and Adlia H. Gilkeson, Infantry, to Columbus, N. Mex., for duty with the First Aero Squadron, Signal Corps.

First Lieuts. Hubert R. Harmon, Coast Artillery Corps; Jack W. Heard, Seventeenth Cavalry; and Whitten J. East, Infantry, to Fort Sam Houston, Tex., for duty with the Third Aero Squadron, Signal Corps.

The travel directed is necessary in the military servce.

Sergts. George I. Sullivan, Henry V. Lucas, and Earl H. Tonkin are relieved from active duty at the Curtiss Aviation School, Newport News, Va., to take effect May 17, 1917, and will proceed to their homes. The Quartermaster will furnish the necessary transportation and pay these soldiers commutation of rations in advance for the necessary number of days' travel, it being impracticable for these soldiers to carry rations of any kind. The journey is necessary for the public service.

Leave of absence for one month on surgeon's certificate of disability is granted Capt. Charles C. Benedict, junior military aviator, Signal Corps.

Under the provisions of paragraph 38, Regulations for the Enlisted Reserve Corps, Sergt. Harold L. Williamson, Aviation Section, Signal Enlisted Reserve Corps, Curtiss Aviation School, Newport News, Va., will be discharged by the Chief Signal Officer of the Army, by reason of his services being no longer required.

Successful Tests of Wright-Martin Model V

New Brunswick.—According to reports received announcing the initial air tests of the Wright-Martin Model V, this model demonstrated exceptional speed and climbing ability. It climbed 9,700 feet in 15 minutes, 16,500 feet in 45 minutes, and made a speed of upwards of 95 miles per hour. The tests were made by Lieut. E. B. Post, and he had as a passenger Stuart McDonald. The Wright-Martin Model V was fully described in Aerial Age for April 9, last.

Dinner to American Fliers

The Aero Club of France gave a dinner in Paris recently in honor of the American aviators at the front. Among the guests were Robert W. Bliss, Secretary of the American Embassy; Daniel Vincent, under Secretary of Aeronautics, and Col. Regnier, Director of Military Aeronautics. Ambassador Sharp was invited, but was unable to attend. Sergeant Major Raoul Lufbery was presented by the club with a gold medal by President Henry Deutsch de la Meurthe, who made a brief address expressing the club's gratitude and admiration for the gallantry of the American aviators.

THE 1916 HALBERSTADT BIPLANE

IN the British publication *Flight*, there appears some interesting information concerning the Halberstadt Biplane, one of Germany's crack fighting machines of which so much was heard last year. The machines examined were in such a wrecked state that it was impossible to allow of scale drawings being prepared, although we may hope for such drawings when it becomes possible for them to be made.

Prior to the war the Halberstadter Flugzeuwerke was known as the Deutsche Bristol Works, when Taubes and Bristol Prier-type monoplane were manufactured. During 1915 the new firm built a speedy biplane scout having a Morane-Saulnier-type body and Oberursel motor—being, in fact, quite similar to the Fokker biplane of that date. In 1916 the firm turned out the improved type which is now the subject of our discussion. This differs from the previous types in several respects.

General Dimensions

Span, upper plane	28′-6½″
Span, lower plane	28′-6½″
Chord, lower plane	5′-1½″
Gap	4′-4″
Stagger	1′-6″
Motor (Argus or new Mercedes V)	120 H.P.

Planes

Main planes are almost rectangular in plan form, the ends being only slightly raked. The upper plane is situated close to the fuselage, and staggered forward.

The camber of the wings is fairly pronounced. Main spars are of the usual I-section with built-up ribs of webs and battens.

There are two pairs of interplane struts, of streamline steel tube, on each side of the body. The attachment of these struts to the spars is effected by means of a metal fitting secured to the spar by two bolts, on which is formed a fork receiving the end of the strut, a bolt passing through both. The struts can thus be hinged sideways so that when bracing wires are slackened, top and bottom planes can lie one on top of the other for transporting. A smaller fork formed on the sides of the fitting serves as an anchorage for the bracing cable, while the incidence bracing cable is attached to a metal clip which passes over a ring contained within the strut fitting.

Wood or fiber packing pieces are inserted between the spar and the strut fitting to give the correct angle necessitated by the staggering of the planes. A quick-release device, similar to that used on the L.V.G. machines, is provided for the bracing cables, enabling the latter to be withdrawn without disturbing their adjustment.

Internal bracing cables are fastened to a long narrow wiring plate bolted to the side of the spar.

One of the accompanying sketches shows the method of attachment of the lower plane to the fuselage. The lugs on the ends of the tubular cross-members passing through the fuselage, in continuation of the wing spars, receive the forked ends of the latter, the locking being effected by means of the pin shown. A tongue formed on each end of the aforesaid lugs serves as an anchorage for the lift wires.

Ailerons, mounted on the upper plane, are operated by a crank lever working in a slot formed in the wing, as in the Albatross machines. Pulleys carrying the aileron control cables are inside the wing, but an aluminum trap door allows for inspection and adjustment. The trailing edge of the aileron is given a slight up-turn or negative curve.

Fuselage

The fuselage is somewhat like that of the Morane-Saulnier and is of wood construction, the longerons being square in section, hollow and bound with fabric. From one of the accompanying sketches it will be seen that the construction of the fuselage is very simple, the struts being kept in position by blocks of wood tacked to the longerons each side of the strut and by ply angle pieces tacked to the struts. The wiring plate for the outside bracing consists of a single sheet-steel plate bent to a right angle and placed in position over the longeron and struts as shown. A bolt at each end of the plate passes through the strut, one of these bolts having an eye formed at its inner end to form the attachment for the cross wire bracing.

Aft of the cockpit the fuselage is covered with three-ply covering. At this part the elevator and rudder control cables pass through long slots, reinforced with metal edgings, in the three-ply. This material is also used for covering the fuselage forward of the cockpit. The top of the latter is in the form of a turtle-deck, which tapers at the rear until flush with the fuselage at a point midway between the tail and the cockpit. This sloping portion of the turtle-deck is built up of stringers over which fabric is stretched. In order to keep the fabric separated a short distance from the sides of the fuselage (to avoid contact with nuts, wires, etc.), a beading is tacked along the corners of the longerons.

The step in the side of the fuselage is fitted with a spring-closed aluminum trap door, the action of which is shown in one of the sketches.

Tail Group

From the accompanying sketch it will be seen that the tail surfaces closely follow Morane-Saulnier practice being exactly similar in plan form. The rudder, however, is larger and of an odd pointed shape. They are constructed entirely of steel tubing, as shown in one of the sketches. The ribs are built up of lengths of tubing, the ends of which are brazed to the tubular trailing and leading edges. Short tubular distance pieces are arranged zig-zag fashion between the upper and lower members of the elevator ribs.

The rudder post is supported by two substantial tie-rods of streamline steel tubing, anchored to the fuselage.

Landing Gear

The chassis is of the ordinary V-type, each V consisting of two streamline steel struts welded to a short tubular skid, which serves as an anchorage for the rubber shock absorber. The rear strut is attached to the fuselage under the rear wing-beam attachment, a lug being formed on this fitting for the purpose.

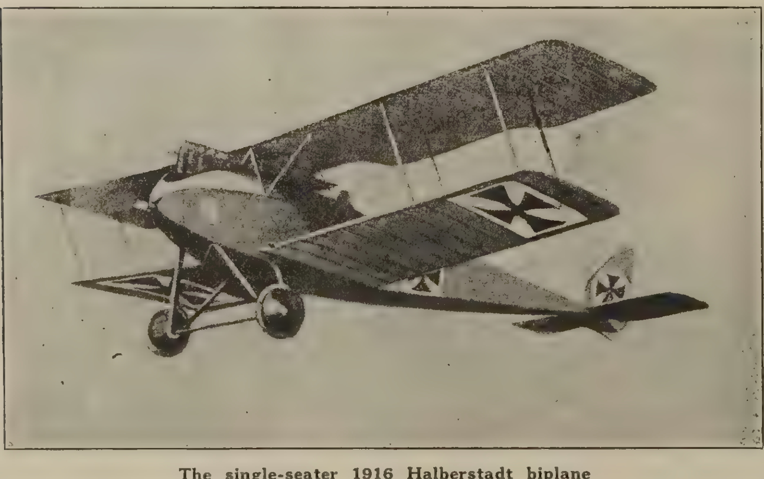
A pair of disc-covered 28-inch wire wheels are mounted on a tubular steel axle 1⅞ inches in diameter. The Chassis Vs are connected by two cross members, consisting of streamline steel tubes attached to lower end of each strut.

The wool tail skid is supported by a tubular steel tripod, and is allowed a certain amount of swivel movement. The forward end is held by elastic shock absorbers, whilst the rear end, which comes in contact with the ground, is fitted with a metal shoe.

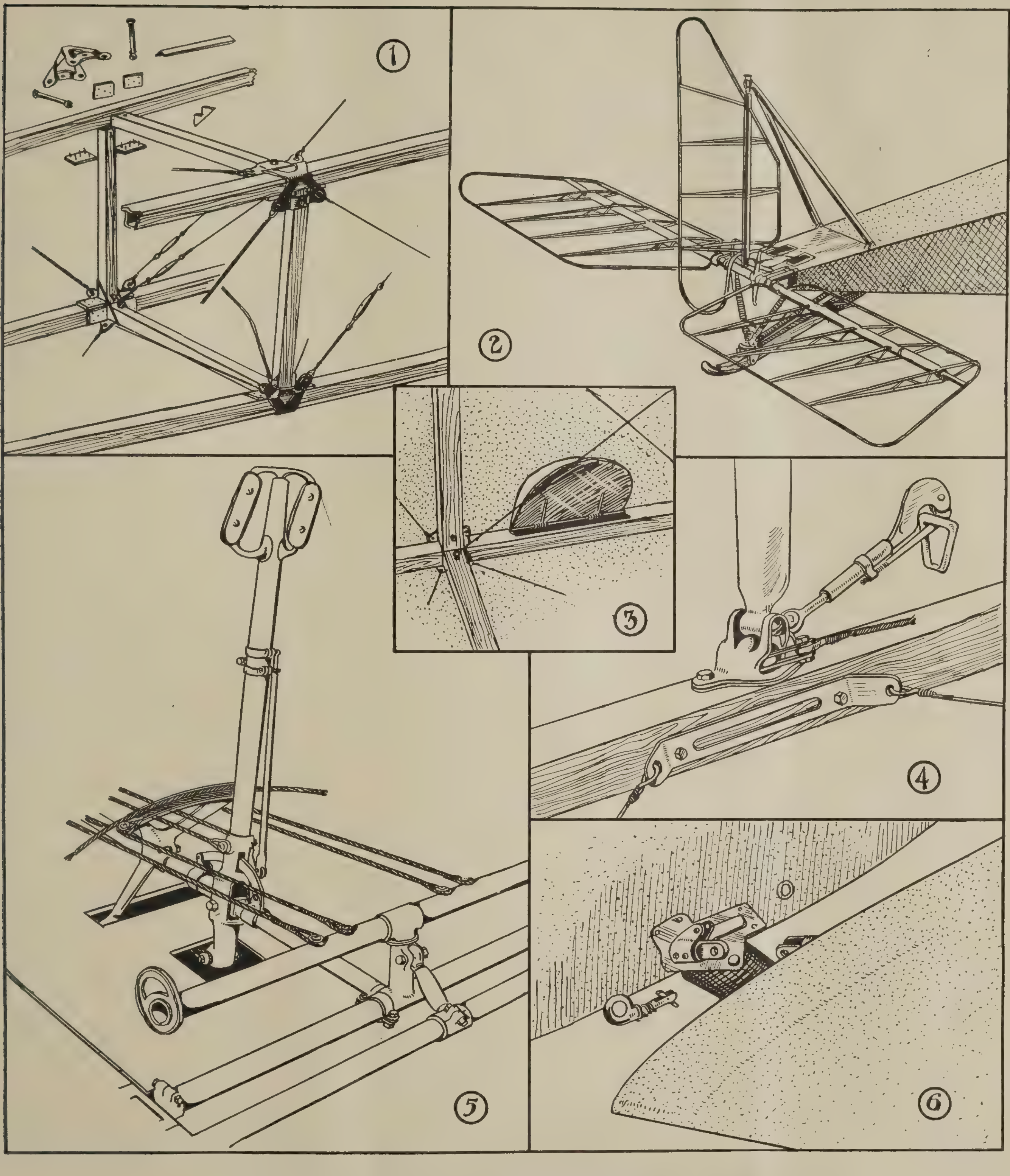
Controls

A control of the Fokker type is fitted, consisting of a vertical column with hand-grip, mounted on a rocking shaft lying fore and aft and supported between two tubular cross members. The vertical column is pivoted so as to rock backwards and forwards (elevator control) over a quadrant, the purpose of the latter being, apparently, to lock the column in position in order that the pilot may have his hands free for firing the gun.

The control cables from the elevators are in duplicate, and one pair is attached to the column just above the rocking shaft, and the other below to an extension of the column which passes through an opening in the floor.



The single-seater 1916 Halberstadt biplane



DETAIL SKETCHES OF THE 1916 HALBERSTADT BIPLANE.

1—Fuselage construction. 2—Metal construction of elevators and rudder. 3—The foot-step trap door on the fuselage, seen from the inside. 4—Interplane strut fitting and quick-release bracing cable attachment. 5—Control column. 6—Attachment of lower plane to fuselage.

Aileron control cables are attached to an X-shaped quadrant mounted on the rocking shaft, the lower arms passing through the floor and carrying the cables from the aileron crank levers; the top arms carrying the cables which are attached to the ailerons near the trailing edge.

A pivoted tubular rudder bar is mounted on the cross member carrying the front end of the rocking shaft. This bar is provided with end plates to prevent the pilot's feet from slipping off, whilst the distance from the seat to the rudder bar can be varied by means of the adjustable link, connecting the bar and the front-spar cross member, shown in the sketch.

Motor Group

As regards the motors fitted to the 1916 Halberstadt, these are, it is understood, either 120 H.P. Argus (Benz type) or the new Mercedes-V. There is no data on hand at present as to the method of mounting the engine, etc., but details may be furnished later.

A service tank for the gasoline is incorporated in the upper plane, having the same section as that of the wings. A portion of the plane is, of course, cut away to receive this tank.

FOREIGN NEWS

BULGARIA

London, May 22.—The simultaneous attack by thirteen warships and twelve aeroplanes on Kavala, a seaport on the Ægean, opposite the island of Thasos, is reported in today's Bulgarian War Office statement. Several houses were destroyed, according to the announcement, but no military damage was inflicted. One of the aeroplanes was shot down.

The Berlin report tells of artillery activity on both banks of the Vardar, between Lake Presba and the Cerna, and on the Struma. Serbian and British aviators successfully bombarded enemy depots, the Paris statement says.

FRANCE

Paris, May 23.—Adj. Raoul Lufberry, of New York, premier "ace" in the Lafayette escadrille, was today awarded the British Millitary Cross by direction of King George of England.

Paris, May 24.—Capt. Delaage, the French officer who had commanded the American Flying Squadron ever since its formation, was killed while flying near Ham on the Somme front, where the squadron is now stationed.

Capt. Delaage set out in a special fast-climbing machine of a new type to attack a German flyer and reached a considerable height, mounting almost perpendicularly, when the engine stopped abruptly and the machine dropped straight to the earth. He was crushed beneath the motor.

Major Mitchell, an American aerial expert now here on a mission, together with all the American aviators off duty and representatives of the United States Embassy, will attend the funeral tomorrow.

Paris, May 11.—Jacqueline Forzane, an actress, who before the war led Paris in setting the fashions, obtained a divorce today from Aviator Kjell Nyegaard. A rumor is current that she is about to marry an Irish Lord who is in the British army.

Nyegaard, a Norwegian, and an active member of the French Flying Corps, went to New York last December with Capt. Hugo Sunstedt, a famous Swedish airman, intending to have built in America a huge triplane and fly across the Atlantic back to France. For some reason their project failed, and Nyegaard is again in the French army air service.

GREAT BRITAIN

London, May 24.—"Four or five hostile airships approached East Anglia (the east coast of England north of the Thames in the counties of Norfolk and Suffolk) shortly before midnight last night," says an official bulletin issued today. "The weather was overcast and a thick bank of rainclouds made observation difficult.

"Four airships appear to have penetrated inland. They followed erratic courses and dropped a number of bombs. One man was killed in a Norfolk village. The material damage is believed to be negligible. The raiders were pursued by our aeroplanes, but thick clouds enabled them to make good their escape."

May 8.—Seven British aeroplanes today shot down seven German balloons in a resumption of a vigorous aerial offensive by British flyers. The weather was clear and especially favorable for fighting in the clouds.

Three of the German balloons were set afire by incendiary shells while far aloft and fell flaming to the ground. Two more were struck down by British planes while hovering close over the Germans lines. In the case of the other two, the British airmen, careless of anti-craft gunfire, slipped up to hangars and dropped explosives on the balloons not yet loosed for flight.

During last night a violent German counter-thrust at a British sector northeast of Fresnoy succeeded in gaining the enemy a little ground, but despite the superiority of the attackers in numbers they did not attain their evident objective—ousting of the British from their trenches.

ITALY

London, May 24.—The Italians yesterday broke through nearly ten miles of Austrian fortification on the Carso Plateau, from near Castagnavizza to the sea, captured several towns and hill strongholds, and swept in over 9,000 Austro-Hungarian prisoners, winning one of the clearest cut victories of the war. Their lines tonight are within ten miles of Trieste, Austria's largest seaport and the heart of "Italia Irredenta."

The Austrian official statement tonight admits the loss of Jamiano, where it says the Austrian troops "had been withdrawn for a kilometre." Elsewhere, it says, the attack along a forty-kilometre front failed to gain. It says the battle continues furiously.

Though the preliminary bombardment, in which ten British heavy batteries shared, lasted for ten hours, the Austrians, in their rock-hewn trenches, seemed taken by surprise, as the number of prisoners, greater even than the British captures on the first day of the battle of Arras, indicates. Cadorna had suddenly switched his attack from around and north of Gorizia, and his troops, debouching from their lines on a bulging front from Castagnavizza to the Gulf of Panzano, seized part of the area south of the Castagnavizza-Boscomalo road, passed Boscomalo and stormed the town of Jamiano, Hill 92, two-thirds of a mile east of Pietrarossa, Hill 77, Hill 58, Hill 21 and the little town of Bagni, a coast bathing resort. A fleet of 130 aeroplanes flew ahead of the troops, dropping ten tons of bombs.

The enemy did not recover from the attack until evening, giving the Italians time partially to consolidate their new positions. When the counter thrusts did come they were thrown back everywhere with what the Rome official statement describes as "severe loss."

JAPAN

The following items are from a recent Japanese paper telling about Art Smith, the American aviator:

At the flight of May 7, at Nara, Smith suffered from rain. And on next day there was a very low cloud which troubled him. The wind was speeding at a very fast rate and the raindrops which was driven by the wind hit the face of Art Smith as hard as pebbles. When the question of whether to make a second flight or not was discussed one Yonezo Samon came out and bravely confronted everyone and said:

"Art Smith is the best aviator in the world and if ever he was endangered at Nara the people of Nara could not face the world. So kindly postpone this second flight until tomorrow."

And listening to this warm-hearted talk of the dentist, the flight was postponed.

"And when he was entertained with the best ceremony at Nagoya, when he saw the Kibi dance in Okayama, when he saw the modern dances at the residence of Baron Shibuzawa, and when he saw the U Gai at Gifu, he was most attentive and watched with keen interest, while his assistants had no interests whatever in such matters. It would be hard to find another American who understands so well the true beauty of Japan as Art did. And it could be understood why Art Smith is regarded as the treasure of the United States."

Smith made a flight at Naruo. After the flight he could not get to his hotel.

The account reads:

"And he returned to the flying field and went into the tent of a refreshment stand in the ground. An old woman of the stand kindly gave him tea. And gathering whatever there is in the tent for covering he went to sleep. When the morning sun broke the old woman of the stand said to herself: "In such a poor tent the world famous aviator slept all night and we should feel grateful for such honor." She watched Art Smith all night.

RUSSIA

London, May 25.—A day of almost complete quiet on all the Russian front is reported tonight by the Russian War Office, and Berlin announces that there is nothing to report. Further evidence of the increasing efficiency of the Russian aviation service is given by the announcement that a German Albatross has been winged. The Russian statement follows:

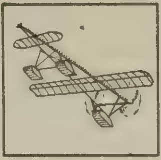
On the Russo-Galician and Rumanian fronts the usual rifle firing occurred. An enemy aviator dropped bombs on Shlok, west of Riga.

On May 10 an encounter occurred southeast of Falicz between an enemy Albatross machine and a Russian machine manned by Capt. Modrah. The enemy machine fell behind the German lines and was destroyed by our artillery. The pilot was wounded and was carried away by enemy soldiers.

French battleplane equipped with the Sperry stabilizer

MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City
PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
LONG ISLAND MODEL AERO CLUB
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BAY RIDGE MODEL CLUB
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INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
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924 Wabash Ave., Youngstown, Ohio
DENVER MODEL AERO CLUB
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BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas
SPRINGFIELD MODEL AERO CLUB
47 Churchill St., Springfield, Mass.
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Paper Tube Scale Model Aeroplane

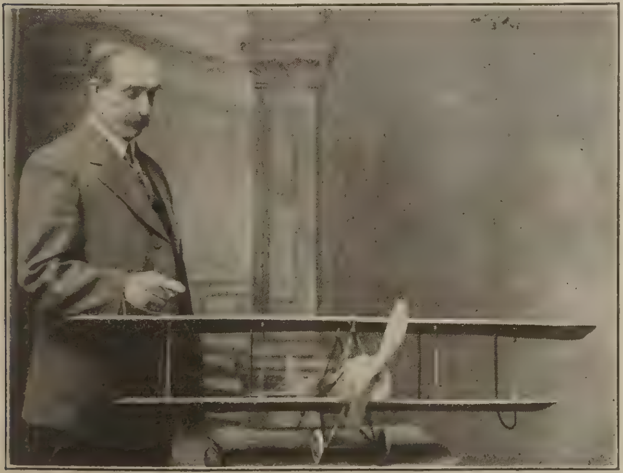
(*Continued from page* 361)

Hold the body of the monoplane with one hand and the propeller with the other. Place the wheels firmly on the ground or floor and release first the propeller and then the model.

The little monoplane will roll a few feet and take the air almost before you realize it, climbing gradually and usually circling. The fastest flights and the best getaways are made when the model flys "tail high" or with the body in a horizontal position. Proper elevation can be secured by moving the main plane along the fuselage. As a rule the motor completely unwinds while the machine is in the air, and at once the model glides swiftly to the ground, landing and rolling a short distance exactly like a big machine ought to do. The percentage of perfect landings is most surprising; indeed, when flown indoors over a gymnasium or dance floor a bad landing is rare.

The paper tube model, while a good flyer in steady winds, is easily upset by gusts and hence is sure to fly best indoors, where the air is calm and the landing surface smooth. The amount of banging these models can survive is a marvel to those who associate crash and bang with smash! Racing these models in an armory or gymnasium is most exciting sport, higher speeds being obtained by adding strands to the rubber motor.

When flown outdoors the model will sometimes rise over thirty feet while fighting a slight breeze and a duration of fifteen seconds is the average. Thrown from the hand or from an elevation, the monoplane will fly with less rubber than that necessary for rising from the ground. This model can be turned into a biplane or triplane with little labor or readjustment; a seaplane type, however, requires considerable skill on the part of the model maker. The disadvantages of the heavier type scale model, whether driven by a gasoline, steam, compressed-air, or rubber motor are overcome by the paper tube type. Ease of construction, inexpensiveness, durability and compactness are qualities not found in any other type of scale model designed to fly.



Mr. G. Rescigno and his L. W. F. scale model. As may be seen from the photograph, the model is a clever reproduction of the original machine and is the outcome of many hours of careful designing and construction.

For experimental purposes the paper tube scale model has a limited field, but should be useful in the quest for new types. The expense involved in building a unique type of flying machine full size and the lack of data for estimating its performance has kept the great majority of our aeroplanes to a standard type. The paper tube model is at best an approximation to its big prototype and any idea of the actual performance of the full sized machine from the flights of the model would be most general in nature. But for those of us who are far from the big flying fields, and for those of us who are not to dignified to play with toys that "go," the paper tube model flying machine is a source of delight and an educator of flying not to be overlooked.

Notice to All Interested in Model Aeroplanes

On Saturday, June the twenty-third, in one of the public parks, the first of a series of model aeroplane contests will be held. Prizes in gold coin, trophies, banners, etc., will be given to the winners. There is no entrance fee. The prizes are offered by Mr. W. H. Logue, Jr., to stimulate interest among sport loving youths of this city.

The contest will be under the auspices of the Broadway Model Aero Club, of which Mr. Logue is director. This club has been progressing finely of late, having secured many new members and its members having built many models. Many prominent persons have been interested, including the Mayor and Superintendent of Schools, Messrs. James H. Preston and C. J. Koch, respectively.

Boys! There is only one chance of your being in the contest if you know nothing about models. Join the Broadway Model Aero Club and you will receive excellent information, talk and lectures regarding the construction of models. Just communicate with the secretary, C. Howard Black, 927 N. Broadway, and he will supply you with any information possible. Remember! The time is limited! Join now and be prepared.

We would like to correct the mistaken idea that many boys have. You do not have to belong to the club to enter the contests. But—you have to have a model that *you* have built or at least assembled.

We now have information that there are one or more model clubs in this city. If their secretaries will communicate with Mr. W. H. Logue he will be glad to supply them with any possible information or to arrange for contests. His address is 931 N. Broadway and telephone is Wolfe 1574.

Remember, boys! Join now. Don't wait until it is too late. Come early and avoid the rush.

The Scout Aero Club of Indiana Meet for May, 1917

		Distance	Duration
1st	Paul Stanley	778′	34.5″
2nd	Marion Loutt	429′	31.1″
	Eck Cochran	530′	22.″
3rd	James Master	300′	16.″

Eck Cochran used a machine 18″ long. There was a continuous stiff breeze blowing. Other machines were around 40″.

Challenge Between Loutt and Hall Marmon

	Duration	Distance	
Marmon	42″	1000′	Straight line
Loutt	27″	775′	

Latest unofficial flight of Loutt—80″ Duration.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Manila, P. I., March 10, 1917.

THE ODOR ENGINE CO.

Gentlemen: Being an aeronautical engineer of mean reputation and no experience, and having been in the Philippine Islands for the past fourteen months, which may account for a great many things, I take great agony in submitting to you for your inspection and approval a diagram of the Matchameto, designed for use on your Odor engine.

I would have sent this to you sooner but I have just escaped from the hospital where I was placed for observation as to my sanity when I showed the plans of this instrument to the Governor General of the Philippine Islands. Be that as it may, I now have the papers to show that I am not insane.

This ignition system, while designed for use on the Odor engine, can be used on any other peculiar make of motor. Throughout the construction I have been very careful to use the cheapest materials obtainable, in fact very few of the parts cost me any outlay of cash, as I had access to the store room of the Aero Squadron while securing data and making observations.

Every one is well aware of the fact that common safety matches are very cheap; so cheap in fact that many millions of them are wasted every year by foolish persons trying to light cigarettes while the surrounding atmosphere is in a disturbed condition. Since we use matches for lighting everything else, why not use them for ignition purposes on motors? Every one will quite readily agree with me that gas will explode or ignite on coming in contact with a lighted match. How to get the lighted match into the gas or odor in the cylinder was the problem. But at last we have solved it, after consuming many bottles of native gin and many dohbe cigarettes.

The matches are placed in the magazines P Q R S, which are just large enough to accommodate a safety match box. The side of the box with the phosphorus paper is torn off, and placed in the spark plugs, or rather the scratch plugs A B C D. The slot in the bottom of the magazines is just large enough to admit one match at a time into the tubes E F G H. V V V V are continuations of the tubes E F G H, and contain a plunger and a spring, a detailed diagram of which is given in the insert. The match drops down into the tube, the spring is drawn back and released by the cam causing the plunger to strike the end of the match and force the match up through the tubes past the strip of phosphorus paper, where it is ignited and sets fire to the charge of odor in the cylinder.

What becomes of the match stem after ignition? This is very easily answered—the heat of the burning odor is of such intensity that the match stem is consumed instantly. By using Japanese matches, the vilest smelling in the world, the power of the motor is increased.

The crank shaft Z is operated by the foot pedals M M, which were borrowed from a Philipino lady's sewing machine while the owner was absent. The crank shaft has two throws set 180 degrees apart. The cam shaft Y has four cams set 90 degrees apart, and is connected to the crank shaft by the connecting rods K L (that is the purpose of connecting rods, is it not——to connect), which are made of bamboo, since bamboo is very easily procured in this country. The ratchet wheels N N on the end of the crank shaft are made of hard wood, and were cut out by a native with a bolo (the same bolo, by the way, which was carried by the famous Aguinaldo). The con. rods U U running from the foot pedals to the ratchet wheels are also made of bamboo. There is a spring beneath each pedal which immediately raises the pedal when the foot is taken off.

As the foot pedal is depressed the crank shaft is turned over one fourth of a revolution, the con. rod causes the cam shaft to also turn over one fourth of the way, drawing back and releasing the spring, which forces the match to one of the cylinders (I have not figured out which one, but that is of little importance). The other pedal is then depressed and the operation is repeated, except that another cylinder receives a light.

It will be readily seen that the faster the feet are worked the faster the engine will fire, in fact the whole machine will probably be on fire in a very short time.

One of the distinctive features of this system is the absence of gears, which are liable to come out of mesh and cause trouble. Another feature is that you do not have to worry about getting the time of fire correctly, in fact any old time will do to fire.

O O O O are bearings in which the crank shaft and the cam shaft operate, and since it is customary to oil all bearings I have added the oil cups X X, which supply oil to the bearings through the pipes T T.

Great possibilities are open with the use of the Matchameto. The tubes E F G H being flexible, the scratch plugs may be removed from the cylinders, and a cork put in their place, and the Matchameto used to drop lighted matches, while the Accordianplane is gliding over the enemy. While thus engaged it might be well for the pilot to play "Nearer My God to Thee" or some other appropriate hymn.

In flying at night different colored matches might be used, and thus messages could be transmitted to the ground.

Another suggestion I would like to make is that in case the mixture in the Odor engine becomes too weak, a bottle of Chlorine water be kept handy and a little of it poured over the matches in the magazine.

Having perfected this piece of ingenuity and damphoolery, I am now working on an automatic stabilizer for the Accordionplane, which I hope to have finished by next week at two o'clock, unless I am again placed under observation.

Very regretfully yours,

IMA P. NUTT.

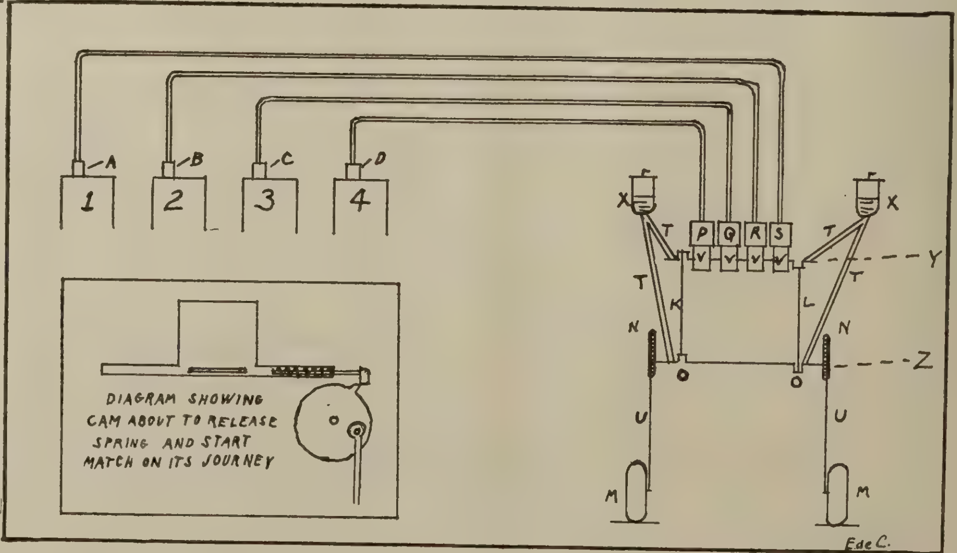

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DIAGRAM SHOWING CAM ABOUT TO RELEASE SPRING AND START MATCH ON ITS JOURNEY
Ede C.

The Match Magneto—Designed for Use with the Odor Engine.

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AIRCRAFT DEPT.
SOLE MANUFACTURERS OF THE
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THE authorities have agreed that the greatest possibility of getting decisive victories is to strike Germany from the air. To do this will require thousands of aviators, and tens of thousands of aeroplanes. How this will be done is told in

***Flying* for June**

How the navies of the world use Aircraft Motherships is discussed in a ten page, profusely illustrated article by Henry Woodhouse.

Admiral La Caze, the French Minister of Marine, reported to the Chamber of Deputies recently that France has 552 coast patrol units, with seaplane stations all along the coast, so that the zone of action of each joins that of its neighbor. Admiral La Caze's statement, illustrated by the types of seaplanes used in this work, appears in Flying for June.

Amongst other important subjects dealt with in this issue are: Plans and Personnel of the Aircraft Production Board; Balloon Training; Hunting Submarines from the Air; Rules and Regulations Governing Aerial Reserve Corps; and News of the Aerial Coast Patrol Units.

Subscription Price $3.00 a Year. **Twenty-Five Cents a Copy.**

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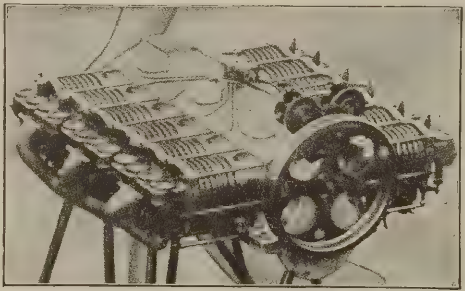

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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ARE NOW READY FOR THE MARKET
Patents allowed and pending.

They actually develop over the rated Horse Power at 900 R.P.M. at propeller shaft—1800 R.P.M. at crank shaft, and are built for CONTINUOUS HEAVY DUTY.

Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
Ignition—High Tension Magneto.
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Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
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Oil Consumption—70 H.P.—¾ Gal. per hour, Good Grade.
Oil Consumption—105 H.P.—1¼ Gals. per hour, Good Grade.

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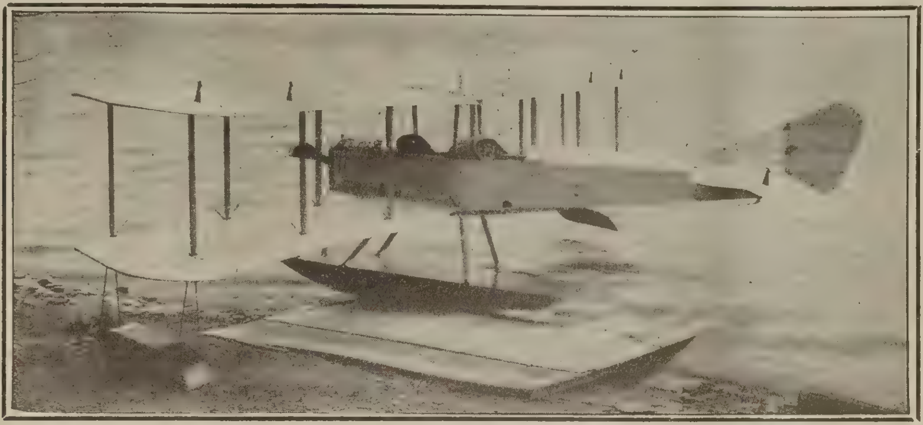

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This machine has been designed particularly for **training purposes,** for either **land** or **water use.** Good inherent stability is secured by careful balance and moderate dihedral wing setting. Control surfaces are of generous dimensions to insure ease of handling under all conditions.

Speed range 40 to 65 M.P.H. with 100 H.P. engine.

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that meet every standard requirement, and in addition

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This remarkable new Dope, besides being absolutely fire-proof, will by our process render your plane fabrics

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Oil and gasoline spilled or splashed on plane surfaces, if ignited by engine backfire, cannot burn fabrics treated with our new dope—the fire cannot touch the fabric and will not spread beyond the oil covered area.

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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed without in any way affecting the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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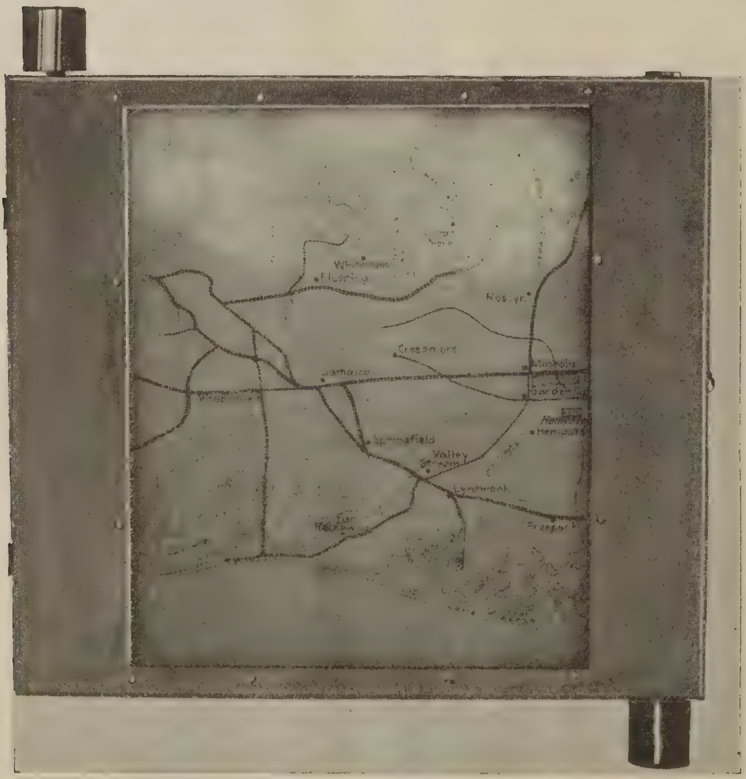

ALWAYS KEEP THE CHART IN SIGHT

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THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps, and Sperry Map Holder, supply this necessity.

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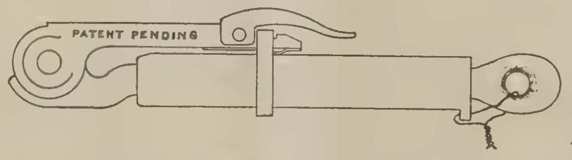
The Bellanca Turnbuckle
A Labor and Time Saving Invention

The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

From the description above given, the advantages of the *Bellanca Turnbuckle* over all other types will readily be seen and appreciated.

Quotations and deliveries on request.

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Automobile practice may not be the best guide for aeroplane practice—except in the matter of ignition apparatus. In the motor car field, the almost universal use of "NORMA" Bearings in the most reliable magnetos, suggests that "NORMA" equipped magnetos will be found most dependable in aeroplane work.

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All price quotations withdrawn. There has been a rise of ten to twenty-five dollars per thousand feet on all classes of this lumber during the last thirty days, and the probabilities are that the grade 3 inches thick and thicker, 6 inches wide and wider, ten per cent; 10 to 17 feet long, ninety per cent; 18 to 40 feet, seventy-five per cent vertical grain, **four sides clear** straight grain, not less than ten annular rings to the inch, will be $200.00 per thousand f. o. b. New York within sixty days. Many foreign buyers are on the Pacific Coast and are taking all offerings. It is advisable to place contracts at once for a season's supply before the price rises further or the grade is exhausted. No aeroplane spruce older than 4 to 6 months is available and spruce should be air dried nine months and longer to achieve the best results. In purchasing, care should be taken to buy from a specialist the grade known as **four sides clear, free from all knots and sap pockets.** Some aeroplane builders not conversant with these specifications have made purchases which were practically valueless for construction work.

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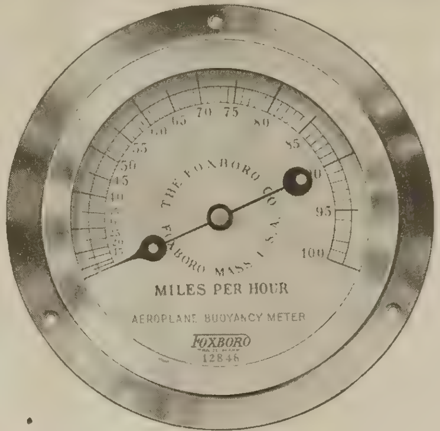

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This "BIG SIX" Engine is the latest development of the HALL-SCOTT FACTORY, and is particularly adapted for use in heavier type land and water machines.

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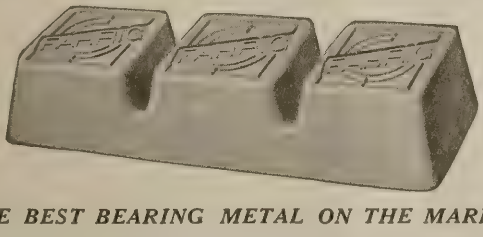

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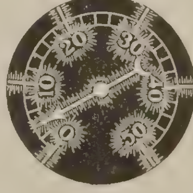

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Burgess Primary Training Tractor Type B. P.

This machine was designed by W. Starling Burgess at the request of the United States Army for a primary training tractor aeroplane having a practical side by side seating arrangement with duplicating controls.

This has been accomplished without sacrificing in the least the efficiency or appearance of the machine.

It fills the urgent need found at present in the aviation schools—giving great range of control and allowing the instructor to be at side of the pupil during flight, thereby facilitating instruction.

This has proven very satisfactory in experimental flights as well as in the official trials thru which this machine passed with great success.

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Manufacturers of the Burgess-Dunne and Burgess seaplanes.
Sole licencees for the Dunne patents.
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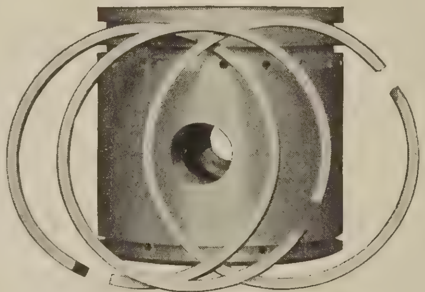
(REG. U.S. PAT. OFF.)

Official U. S. Army Performance

Speed Range, 38-75 M.P.H.
Climb in excess of 3000 ft. in 10 mins.
With 2 persons and 4 hours' fuel.
Sturtevant 140 H.P. Aluminum Motor.

Unusual Load-Carrying and Safety Reserve.

STURTEVANT AEROPLANE CO.
Jamaica Plain, Boston



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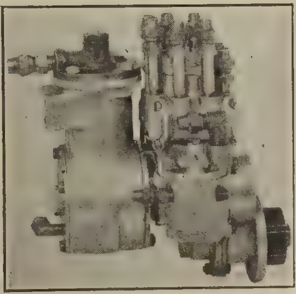
Starts High Powered Engines Cold on Low Pressure



Supplied to the U. S. Navy

THE marked efficiency of the Christensen Self Starter is perhaps best suggested by the results of a test on a Hall-Scott Motor made at the Standard Aero Mfg. plant in Plainfield, N. J. There on a tank of air of 250 pounds pressure, 28 complete starts were made without recharging the tank, and the last start was made on the low pressure of 100 pounds.

"Start Your Engine From Your Seat"

(WRITE FOR BOOKLET)

THE CHRISTENSEN ENGINEERING CO.
MILWAUKEE, WIS.

The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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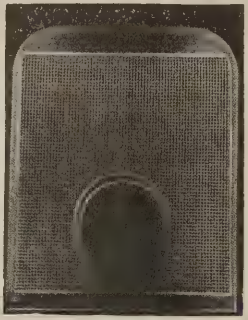

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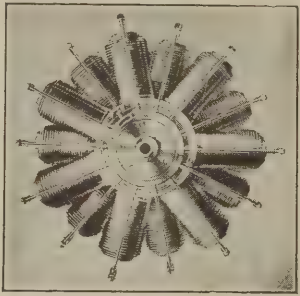

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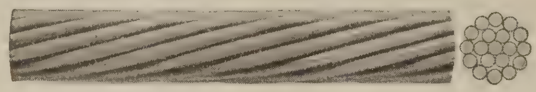

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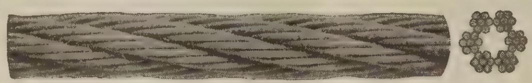

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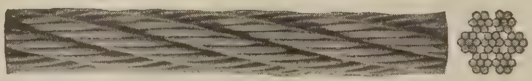

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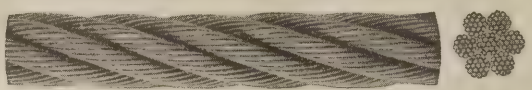

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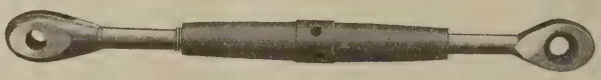

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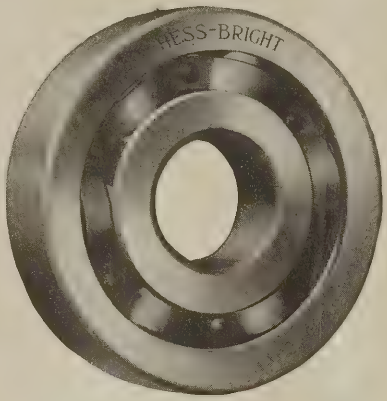

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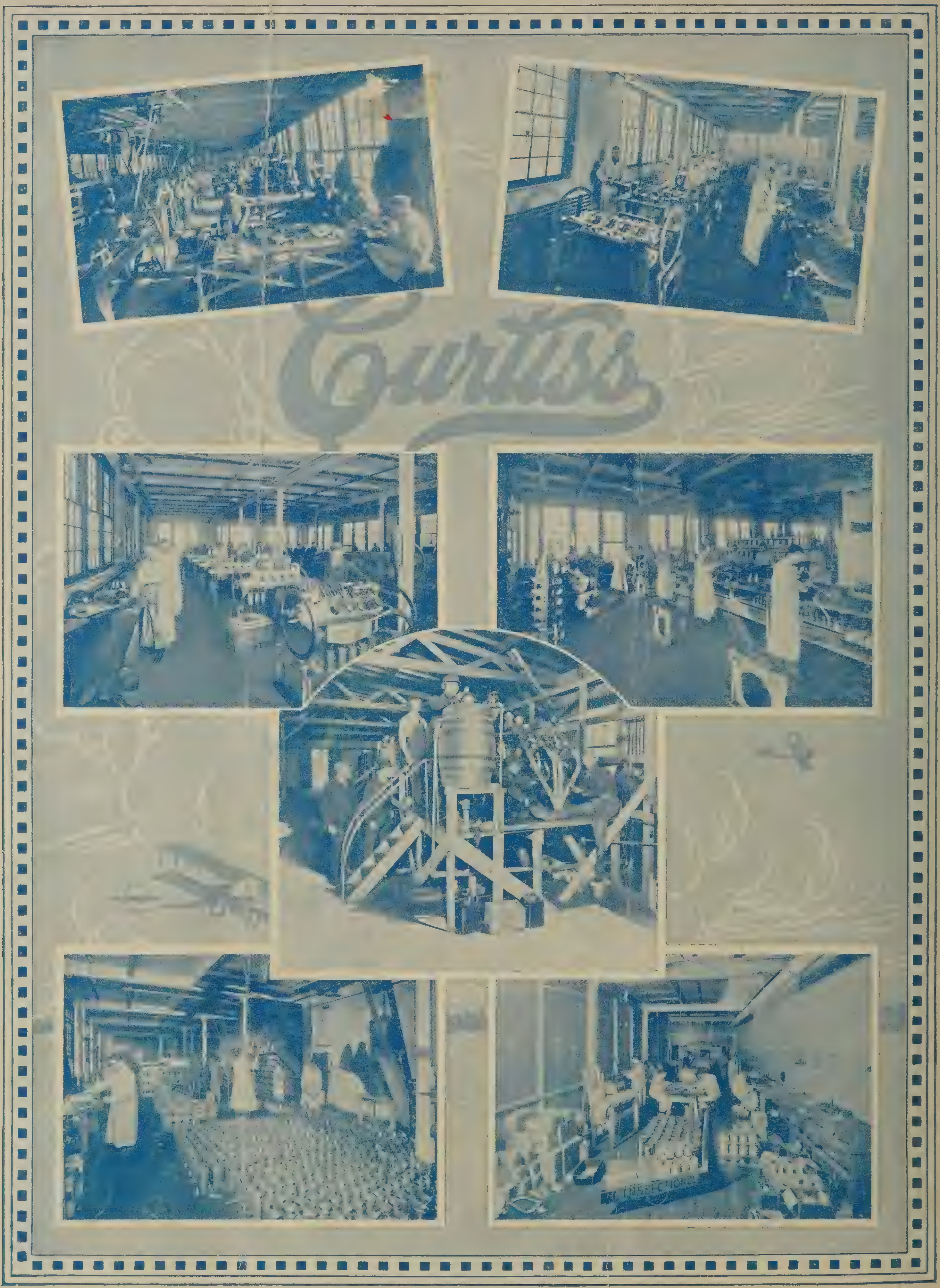

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Vol. 5, No. 13 JUNE 11, 1917 10 CENTS A COPY

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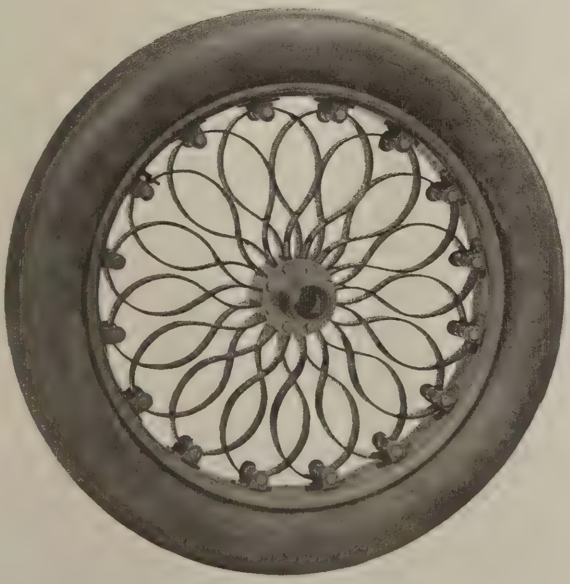

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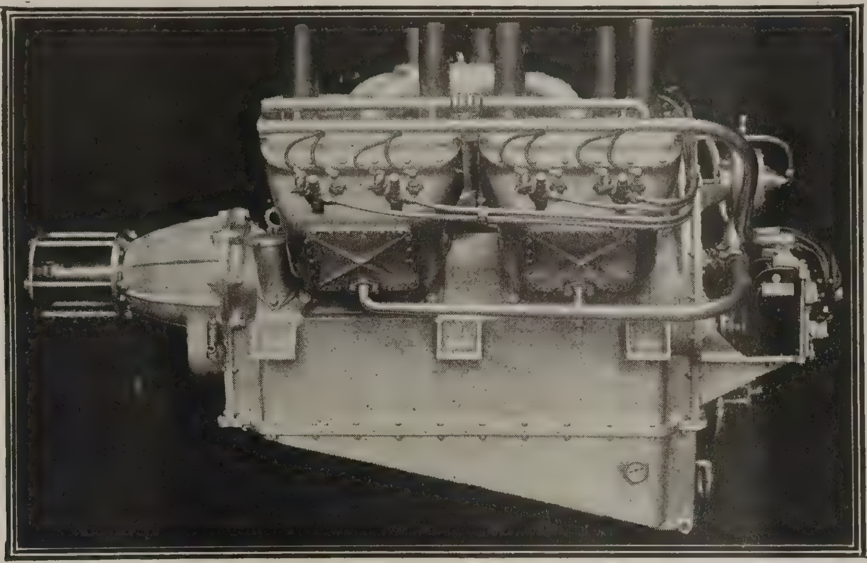

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AERIAL AGE
WEEKLY

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THE TRADE AUTHORITY
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VOL. V NEW YORK, JUNE 11, 1917 No. 13

THE TORPEDOPLANE—AN AMERICAN INVENTION—SUCCESSFULLY USED BY GERMANS AGAINST BRITISH SHIPPING

EVIDENCE that the Germans appropriated Rear-Admiral Bradley A. Fiske's idea of the torpedoplane, and used it in torpedoing the 3,000-ton British steamship *Gena,* off Aldeburgh, on May 1st, was received by the Aero Club of America, and it is feared that the German torpedo-launching seaplanes will become an even more terrible weapon in destroying Allies' ships on the North Sea, Baltic Sea, Adriatic Sea and Black Sea than the submarine has been, because seaplanes can be built quickly, only require one or two men to operate them, and can operate against ships swiftly and almost with impunity, and twenty seaplanes can probably be built for the price of one submarine.

The torpedoing of the *Gena* by a German seaplane was reported by the British Admiralty on May 2nd. The report read as follows:

"The British steamship *Gena* was sunk yesterday (Tuesday) by a torpedo discharged from a German seaplane off Aldeburgh. All hands were saved. Another seaplane concerned in this attack was brought down by gunfire from steamship *Gena* and the crew were made prisoners." The following is the German version of the incident sent out from Berlin on May 2nd:

"Yesterday morning a number of our aeroplanes attacked some enemy merchant ships off the Thames and sank a large steamer of about 3,000 tons. One of our machines has not returned, and it is supposed that it is lost."

In connection with the above, it is stated by the Admiralty that this method of attack was first practised successfully in August, 1915, by R. N. A. S. pilots, who sank several ships in the Dardanelles by torpedo from seaplanes.

A sketch of one of the German seaplanes that participated in the attack against the *Gena,* showing the pontoon arrangement for holding the torpedo, which was received by the Aero Club of America today, shows that the arrangement for holding the torpedo in the German seaplane is exactly like the arrangement on Admiral Fiske's torpedoplane. The torpedo is held between the two pontoons of the seaplane with a bracing to keep the torpedo from moving while the seaplane is flying.

The receipt of this evidence created quite a stir in aeronautic and naval circles, and will hasten the tests of Admiral Fiske's torpedoplane, which is being developed entirely at private expense, but with the Navy Department's approval, Secretary Daniels having given written permission to Admiral Fiske to proceed with the work.

Several special torpedoes suitable for launching from a seaplane which promise to give revolutionary efficiency were ordered by the Aero Club of America for Admiral Fiske in February, and one of them has been completed. Mr. Inglis M. Upperou, the President of the Cadillac Company of New York, has placed at the disposal of Admiral Fiske a 125-H.P. seaplane of the "Aeromarine" type, also his seaplane station "somewhere in America" for the launching experiments, which are being conducted with a dummy torpedo. The first real torpedo which has been developed by Mr. Frank M. Leavitt, the expert of the E. W. Bliss Company, who is considered one of the world's foremost experts on torpedoes, being responsible for the present efficiency of the Whitehead torpedo, will be ready for tests within a week. Owing to its smallness of size and great speed and power, this torpedo is considered to be a revolutionary thing.

A committee of the Aero Club of America, including Mr. Alan. R. Hawley, president of the club, Henry Woodhouse, Rear-Admiral Robert E. Peary, John Hays Hammond, Jr., F. Trubee Davison, Schuyler Skaats Wheeler, Lawrence B. Sperry and Henry A. Wise Wood are co-operating with Admiral Fiske in this work. The committee, together with Messrs. Inglis M. Upperou and Harry B. Wise, manager of the Aeromarine Company, of Keyport, New Jersey, visited the seaplane station last week and arranged for tests with the torpedo dummy to try out the launching device and train the aviator. The regular torpedo will follow.

Mr. Alan R. Hawley, president of the Aero Club of America, spoke feelingly on this subject. "It is a shame," said Mr. Hawley, "the way we Americans invent things and then sit back and let other countries get the benefit of our inventive genius. It was so with the submarine itself, then with the Maxim gun, the aeroplane itself, the Lewis gun, now the torpedoplane—only to quote some of the most important military inventions. But we are soon going to have a torpedoplane of our own, and I am assured by the Bliss Company, which has very generously offered to make these torpedoes free of charge, that it will be an easy matter to turn them out by the thousands. as the preliminary work of developing the first practical torpedo of this kind has practically been done.

"While owing to the fact that the German torpedoplane has shown its military value by sinking the *Gena,* it would be absurd to say that the German torpedo was not efficient, I want to express my belief that this new torpedo of Mr. Leavitt's will be just as superior to the German torpedo as his large torpedoes are superior to the large torpedoes of other nations. It is an actual fact that the American torpedo is the best torpedo made, thanks to Mr. Leavitt."

Rear Admiral Bradley A. Fiske, when seen at his home, 128 West 59th Street, declined to make any statement, saying that he was under orders from the Secretary of the Navy to that effect. He admitted, however, when the Aero Club of America offered to pay the expenses of developing this invention without any expense to the Government he asked permission of the Secretary of the Navy to conduct experiments and the Secretary of the Navy granted permission.

Rear-Admiral Robert E. Peary, the chairman of the National Aerial Coast Patrol Commission, points out that if the Germans can use the torpedoplane, the British also can; in fact, that a British naval aviator did sink four Turkish ships in August, 1915, in the Sea of Marmora. "I see no reason," says Admiral Peary, "now that the British have seaplanes, like one for instance, which recently carried twenty-one people to a height of seven thousand feet, why they should not use torpedoplanes carrying the longest range torpedoes suitable for sinking battleships, because these torpedoes weigh each less than twenty-one people. As I understand the situation, the Germans have mined the sea near their coast to a distance of many miles, so that their submarines can go out through the shallow waters, where there is not depth enough to submerge, unmolested by British watercraft; that the British watercraft could go into these shallow mined waters and drag out the mines and stop the submarines from coming out, if it were not for the presence nearby of German heavy ships, which can come through the mined waters, since they know where the mines are, and drive off any small British craft. If my understanding is correct, and I believe it is, it seems thoroughly possible to build, say one hundred torpedoplanes, carrying heavy torpedoes, and use them to keep away the German battleships. If the German battleships can thus be kept away, and I believe they can, then the British watercraft can work their way, slowly but surely, right up to the German coast, at least up to within range of their forts, and thus actually stop the submarines from coming out and thus absolutely abolish what we call the 'submarine menace.'"

Mr. Henry Woodhouse, member of the Board of Governors of the Aero Club, told how the revolutionary Leavitt Torpedo was developed:

"Early in January, 1917," said Mr. Woodhouse, "the civilian leaders of the movement to develop our national defenses, after taking stock of the military resources of the United States, came to the conclusion that, owing to our small Army and Navy and general unpreparedness, the only hope of success on the part of the United States in case of war would be in developing some powerful new instrument. A committee consisting of Messrs. Alan R. Hawley, Rear-Admiral Peary, Henry A. Wise Wood and myself made an investigation with the purpose of finding one or more new instruments, the value of which would be so great that they would give predominance to the side which employed it. After looking over the field of inventions, the Committee came to the conclusion that the torpedoplane patented by Rear-Admiral Bradley A. Fiske in July, 1912, was a revolutionary invention of tremendous possibilities.

"The Committee then asked Admiral Fiske to deliver an address on the subject, which he did at the Aeronautic Conference held in connection with the First Pan-American Aeronautic Exposition, Grand Central Palace, New York City. Admiral Fiske's address created great interest and, as a result, a fund was set aside by the Aero Club for the purpose of defraying the expenses of the experiments of developing the torpedoplane. Admiral Fiske was asked to be the chairman of a committee to supervise the work of developing the torpedoplane and he appointed the following as members of his committee: Alan R. Hawley, Rear-Admiral Peary, Henry A. Wise Wood, John Hays Hammond, Jr., Frank M. Leavitt, F. Trubee Davison, Schuyler Skaats Wheeler, Lawrence B. Sperry and myself.

"The Committee had the choice between concentrating its efforts in developing large seaplanes and training aviators to drop full-sized Whitehead torpedoes, which weigh 2,500 pounds, are 21 inches in diameter and 17½ feet long, or to develop a smaller torpedo, small enough to be carried by any of the two-passenger flying boats or hydroaeroplanes being used very generally. The Committee came to the conclusion that, owing to the fact that there were only very few aviators in the United States who had any experience in piloting a large seaplane and, owing to the lengthy experience that would be required before sufficient experience was given in dropping such heavy weights from an aeroplane, it would be best to concentrate efforts in developing a small torpedo, weighing less than 200 pounds, which could be dropped from the average two-passenger seaplane by almost any aviator. This would make it possible, in time of war, to press into service for launching of torpedoes, almost every civilian, naval and military aviator who had had sufficient experience to pilot a machine.

"At first it seemed as though it would be impossible to develop an automobile torpedo weighing less than 200 pounds, having a range of about 1,500 yards at a speed of about 25 knots, but the Committee was willing to have experiments carried out regardless of the possibility of failure, and three leading experts on torpedoes promptly took up the work and soon advised the Committee that such a torpedo could and would be developed. The Committee was led to decide this way greatly by the results of the excellent work of Volunteer Aerial Coast Patrol Unit No. 1, of which F. Trubee Davison is the head, which led hundreds of other college men to interest themselves in aeronautics. It was realized that thousands of men would follow the example of the members of Unit No. 1, and that would make it possible, in case of war, to quickly organize squadrons of aviators equipped with torpedoplanes sufficiently powerful to sink destroyers, transports and other non-armored ships.

"Larger torpedoes would, of course, sink armored ships. For these larger seaplanes are required, which we are now making.

"So the United States can make another valuable contribution, possibly the most valuable, towards the defeat of Germany and the ending of the war, because in the making of aeroplanes, as well as torpedoes, the United States, Great Britain and France together can certainly make more than Germany."

Aeronautic Workers Exempt from Draft Bill

FIRST among those exempted from the selective draft will be the skilled employees in the aircraft factories of the country. The aerial corps of the army and navy have pointed out to Congress the embarrassment the nation feels at the present moment through the lack of an organized aerial service. Thousands of aeroplanes of the land and naval types must be rushed to completion and more than 5,000 students will be trained as soon as practicable in the art of military aviation.

That these thousands of needed aircraft may be made ready speedily the government will need the service in factory and at aerodrome of all the skilled mechanics now at work in the aeroplane factories.

The effort in all instances is to avoid the mistakes that Great Britain and France made during the first year and a half of the war, denuding the industrial plants necessary for the progress of the war of the skilled men needed there. The selective draft has been designed to remedy that fault; to fit the round men into the round holes and to put the other men where they can serve best. Thus the workmen engaged in the manufacture of the materials of warfare will be recognized as serving no less than the man of greatest use on the battlefield.

President Wilson summed up the situation wisely, when in his proclamation he said:

"It is evident to every thinking man that our industries, on the farms, in the shipyards, in the mines, in the factories, must be made more prolific and more efficient than ever, and that they must be more economically managed and better adapted to the particular requirements of our task than they have been; and what I want to say is that the men and the women who devote their thought and their energy to these things will be serving the country and conducting the fight for peace and freedom just as truly and just as effectively as the men on the battlefield or in the trenches. The industrial forces of the country, men and women alike, will be a great national, a great international service army—a notable and honored host engaged in the service of the nation and the world, the efficient friends and saviors of free men everywhere. Thousands, nay, hundreds of thousands, of men otherwise liable to military service will of right and of necessity be excused from that service and assigned to the fundamental, sustaining work of the fields and factories and mines, and they will be as much part of the great patriotic forces of the nation as the men under fire."

British Government Looks to American Aeronautic Industry for Decisive Help

MAJOR BAIRD, British Under Secretary for War, and representative of the Air Board in the House of Commons, emphasized in a statement which he gave to the press recently that it was his opinion that the United States would be the decisive factor in striking Germany through the air.

"Just as Unwise to Build All Battleplanes as to Build All Dreadnaughts"

Major Baird compared the air service to the fleet, saying: "It would be just as unwise to build all battleships as it would be to build all dreadnaughts. It is necessary to develop all the elements of the air service without prejudice to any part of it.

"The mechanics must be as efficient as the pilots. The obsolete machines are just as necessary to train men to fly as fighting machines are necessary to meet the enemy.

"In America you have advantages far superior to any we have had. Climatic conditions make it possible to train men all the year around in many parts of the United States, which is not so here. You have unlimited resources in raw material, and you have all our experience to assist you, for everything in the Anglo-French service is at your commond.

"America's aid will be priceless. Her fighting men will be devilish good, as is already proved by the splendid work American airmen are doing with the French Army.

Some of the finest airmen in the war have come from the countries of big open spaces. Canada, South Africa and Australia have produced any of the best air fighters of the war, and it will be the same with the United States. There seems to be something about such an environment which develops resourcefulness and initiative."

THE NEWS OF THE WEEK

S. A. E. Meeting in Washington, D. C.

The program for the S. A. E. meetings to be held at the Bureau of Standards, Washington, D. C., June 25th and 26th, has practically been completed. On the 25th, Monday, the Committee of Standards will hold its meeting at the Bureau of Standards and will be conducted about the grounds and buildings of the Bureau.

On the 26th the business session will be held in the morning, at which the President's report will be read. The Standards Committee will also report. In the afternoon the technical session will be held and papers will be read on Motor Trucks, Aircraft, Submarine Chasers and Farm Tractors. A paper will be read by I. W. Seddon, Wing Commander of the Royal Naval Air Service on "Design Production of Aircraft in War Time." The list of speakers for the banquet, which is to be held on the evening of the 26th at the New Willard, will be Secretary of War Newton D. Baker, Chief Signal Officer, Brig. Gen. George O. Squier, Col. Chauncey B. Baker, Chief of Transportation of the Quartermasters Corps. The guests will consist of members of the S. A. E., all members of the Council of Naval Defense, Advisory Commission and a large number of Army and Navy officers connected with the Engineering Department.

Benoist Activities

The Benoist Aeroplane Company, Sandusky, Ohio, is now operating the Summer Flying School on Sandusky Bay. Sandusky Bay is the most southern point of the Great Lakes and is a well protected sheet of water; being situated in a very level country, and near no large city, makes it an ideal location for a training school.

Three machines are in service at the present time, two flying boats and one hydroaeroplane. The students are given their first instructions on the flying boats, and afterwards for their tractor experience on the hydro, and after that finishing on the land tractors. Other machines will be added to the school from time to time as they are needed.

The Benoist Company is now developing a very light tractor machine with a small but efficient motor. This machine will only carry the aviator alone, and while not very fast, it has a very low get-away and landing speed. After the student has finished with the instructor, the idea is to rent these small tractors to the students at a small rental per day so that they can keep on practicing until they become really proficient.

Unlike the usual flying field, the hangars and runways of the flying school are only a few minutes' walk from the central part of the town. The City of Sandusky has granted a lease for a term of years to the Benoist Company for the use of East Battery Park, which is a municipal fill on the bay front in the downtown district, and the company has erected hangars and shops on this ground so as to centralize and combine their school with the shops and office.

Curtiss Schools Ready to Train 100 More Aviators

The Curtiss Schools at Newport News, Buffalo and Miami are ready to train one hundred more aviators and prospective students who applied some time ago and found the schools training to the limit of their capacity can now get training promptly. The Army has sent the students, who were under training at these schools, to take the preliminary course at the various universities, the schools are, therefore, open for a new lot of students.

DN-1 in Test Flight

Pensacola, Fla.—Details of the trial flights of the first United States army dirigible ever built in this country, which is the product of the Connecticut Aircraft Company of New Haven, Conn, have been received. The flights were made at Pensacola, Florida.

Leaving the floating hangar at the aeronautic station at 5 o'clock Friday afternoon, April 20, the DN-1 ascended to a thousand feet altitude, headed across the bay, sailed over Santa Rosa Island, then pointed shoreward, circled over Pensacola, and returned to the yard—the first voyage of America's first army dirigible, and a perfect success.

The trial flight, which was made by the company's pilot, Hans O. Stagel, and crew, was to test buoyancy, speed, and ascertain a number of technical points.

Two landings on water were made and ascent and descent were accomplished by balloonette steering entirely, no gas being lost from bag to make descent.

The dirigible's flight on the water was followed by a number of speed boats from the navy yard, among which was Captain Jayne's, with the commandant and a party aboard. Lieutenant Commander McCrary, and others.

The remaining tests will be completed within the next several days and the air cruiser turned over to the government.

Thus will have been brought to a successful conclusion a work begun over two years ago by the Connecticut Aircraft Company.

Rebuilt several times, the DN-1 in its present form was produced under direction of C. F. Smyth, general manager of the company, who took hold of the management of the company's affairs last July.

The DN-1 reached Pensacola last December, and work of assembling and erection was begun in January, under the supervision of General Manager Smyth, and the company's pilot, Hans O. Stagel, was placed in charge of the work. Its capacity is eight men, and it cost $46,000.

Barlow Bomb Tested

Washington, D. C.—A new aerial bomb, designed by Lester P. Barlow, at one time a member of Villa's army in Mexico, was exhibited to the House last week by Representative Tilson, Republican, of Connecticut. On the claims made for it the new weapon may help to solve the problem of meeting the submarine menace.

According to Mr. Tilson, young Barlow, who is now working in behalf of the United States Government, first conceived his invention while in charge of munition plants for Villa. Before perfecting it Villa's attitude toward this country became hostile and Barlow left Mexico. He submitted the idea for the new weapon to the War Department and tests were subsequently made at Sandy Hook. It is said that it destroyed everything around it within a radius of 300 feet. Mr. Tilson said that the exploding device could be made to detonate the charge with terrific force under water when dropped from any height from an aeroplane, thus promising to be an effective weapon against submarines.

DePalma Experimenting with Aeroplane Engine

Cincinnati.—Ralph DePalma, who owns the Packard aeroplane engine racing car, is experimenting with this engine while training for the speedway races here. DePalma is determining what improvements are necessary and is keeping the Packard Company and the Government advised.

P. D. Wagoner, since 1910 President of the General Vehicle Co., Inc., manufacturers of the Monogoupape Gnome Engine, was much interested in aeroplane motors while in Europe before the war, but had then little thought of building them for war purposes.

10 Hispano-Suiza Aviation Engines a Week

New York.—Production of the Hispano-Suiza eight-cylinder aviation engine has now reached about ten a week at the Wright-Martin factory in New Brunswick, N. J., the old Simplex plant. It is expected that production will be steadily increased to at least ten engines a day by the end of the year, and the plane factory will be easily able to keep pace with the engine production or even to exceed it. To date about forty engines have been sent to France, the first passing the French Government test with flying colors, proving to be interchangeable in every detail with the engines made in French factories. The engine produces 150 h.p. at under 1,500 r.p.m. and in a recent test a plane fitted with one of these engines attained 9,700 feet in 15 minutes, getting off the ground in 5 seconds, with a passenger as well as the pilot.

Rickenbacher Called to Washington

Detroit.—Eddie Rickenbacher has been called to Washington for consultation regarding the starting of aviation practice work by the racing drivers aviation corps which was formed through his efforts.

Flies At Rate of 2 Miles a Minute

E. K. Jaquith, attached to the Third Aerial Coast Patrol, made a remarkable flight June 2nd when, with H. H. Pumpelly as observer, he flew from Atlantic City, N. J., to Mastic, L. I., a distance of approximately 225 miles, in one hour and fifty-four minutes, or at a speed of just less than 120 miles an hour.

Conditions were nearly ideal for the flight and, considering the possibility of the aeroplane having deviated from the crow's course by a margin of five miles for the entire distance, the machine attained a speed of two miles a minute.

Personal Paragraphs

Lakewood, N. J.—David M. Rorer, of Francis Mills, N. J., was last week burned to death when an aeroplane he was piloting fell into a tree and caught fire. As Mr. Rorer was strapped in his seat he was unable to free himself from the machine.

Ladislas d'Orcy, formerly with the Aeromarine Sales & Engineering Co., of New York, is now aeroplane designer with the Lewis & Vought Corporation, 20 West 57th Street, New York City.

G. W. Cravens has become associated with The Elkhart Carriage & Motor Car Co. as chief engineer.

Frederick Zimmer was fatally injured in a fall from a hydro-aeroplane at Buffalo on May 30. The cause of the accident is unknown.

Navy Airships Ready August 15

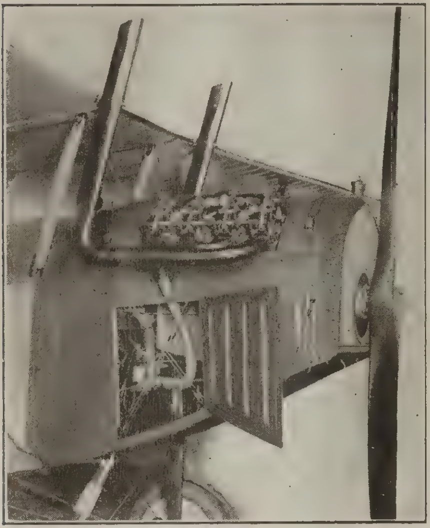
Washington.—An unofficial trial of the first of sixteen non-rigid dirigible coast balloon scouts ordered by the Government from a design by Naval Constructor J. C. Hunsaker, of the Bureau of Construction and Repair, has successfully been made. It consisted of a flight of about 400 miles between Chicago and Akron, O., which started Monday midnight and ended soon after 4 P. M. yesterday.

The news leads the Navy Department to expect to have the entire sixteen dirigibles at work along the Atlantic Coast by the middle of August. Crews for their operation are being trained at the naval aeronautical station at Pensacola, Fla. An older type of airship is being used for the purpose.

The dirigibles are built after a British type known as the "Blimp," which has proved of value in the detection of submarines while approaching the English coast. The American dirigibles will be operated in pairs from special bases ashore and will be expected to serve as the "eyes" for submarine chasers. They will be fitted with wireless.

The Government gave out contracts for the building of nine of these airships by the Goodyear Rubber Company, and seven others are being turned out by the Goodrich Rubber Company, the Curtiss Aircraft Company and the Connecticut Aircraft Company.

The trial was made by the first product of the Goodyear Company. The Government specifications are for a speed of forty miles an hour. About thirty miles an hour was made in the unofficial test, but all other things about the working of the new dirigible were so successful that no fear is entertained of making the speed requirement at the official test within a few days.



A close-up view of the new engine housing arrangement on the latest Curtiss J-N.

New Camp for Aviation Students

Aviation students training at West Palm Beach, Fla., are to be transferred to summer quarters at Huntington, L. I., it has been learned. Henry P. Davison of J. P. Morgan & Co., has already constructed hangars for the camp.

Mr. Davison, Payne Whitney, Harry Payne Whitney and L. S. Thompson are among the men said to have offered the Huntington site to the Government and to operate the camp at their own expense, providing aircraft and other equipment.

Alan R. Hawley, President of the Aero Club, estimated the project would cost about $50,000 a month if carried out on the scale reported.

It is expected that by July 1 Aerial Coast Patrol Unit No. 1, consisting of Yale students now at West Palm Beach, will have been transferred to Huntington with their machines.

Mr. Davison paid the unit's expenses at West Palm Beach. The camp there was established by the America Trans-Oceanic Company.

In the unit that went to West Palm Beach two months ago were F. Trubee Davison and H. P. Davison, Jr., sons of the banker; Robert A. Lovett, son of Chairman Lovett, of the Union Pacific Railroad; John V. Farwell, 3d; John Vorys, Albert J. Ditman of Englewood, N. J.; Wellesley Laud Brown, Artemas L. Gates, Charles D. Wiman, A. D. Sturdevant, Allan Ames, Reginald C. Coombe, Oliver B. James, G. Franklin Lawrence, Frederick Beach, Kenneth Smith, Curtis Read, Bartow Read, David Ingalls, William Thompson, Frank Lynch, Kenneth McKleish, Graham Brush, Henry Landon, Samuel S. Walker, Charles Stewart and Archie McIlwaine.

Northampton County Aero Club Meets

Easton, Pa.—The first meeting of the Board of Governors of the recently organized Northampton County Aero Club was held in Easton, Pa., on May 31st. In an address which was very instructive and entertaining, Mr. Augustus Post of the Aero Club of America spoke of the work of preparedness which is being carried out all over the country by the Aero Club of America and its affiliated clubs. He told of the appropriations for aeronautics made by the different countries, and especially that of the United States. Plans of the Government for training aviators were spoken of, and an interesting discussion was held.

The Club's work having advanced so slowly a committee of three was formed to advance the work. This committee consists of Robert B. Bridge, Chairman; Frank J. Reeder, and Harold T. Magee.

After the meeting, Mr. Post extended an invitation to the Northampton Club to affiliate with the Aero Club of America, and on the following morning inspected the proposed flying field of the club.

A list of the board of governors follows:

Officers

George R. Elder, Sr., President; Robert B. Bridge, 1st Vice-President; Charles T. Hess, Treasurer; George M. Shook, Secretary.

Board of Governors

Charles T. Hess, Harold T. Magee, W. J. Priestly, Norman G. Wilson, Robert Wilbur, F. B. Franks, Willis A. Flory, Thomas J. Kickline, Dr. Howard Ott, John A. Miller, Wm. H. Milchsack, Howard Riegel, Henry MacKeen, Henry Chidsey, George R. Elder, Sr., C. Norvin Rinek, H. W. Zook, W. Evan Chipman, R. B. Bridge, C. M. Laubach, T. A. H. Hay, Frank J. Reeder.

The Club has been assured funds for the purchase of a training machine and the necessary equipment to train men, including a hangar and a flying field.

After the training is under way, a campaign will be carried on to secure funds for speed and scouting machines for the protection of munition plants in the vicinity, and for scout work wherever required.

Efficiency Booklets

The National Institute of Efficiency is planning a series of authoritative handbooks of the war in continuation of the Monographs of Efficiency. The first is being written by Mr. Henry Woodhouse, Governor of the Aero Club of America and a member of the Board of Governors of the Institute. It deals with "The Eyes of Our Army and Navy." Others of the series are "Efficiency and Naval Defense," by Rear Admiral Bradley A. Fiske; "Efficiency and National Defense," by Major General Leonard Wood, and a monograph by Mr. E. St. Elmo Lewis dealing with business organization in the war.

French Aeronautical Instructor Arrives

Theophile Mathieu, famous French aviator, has arrived in this country to take charge of the intensive training of a number of aviation students. Mathieu is one of the most noted battle-pilots of France. Next to Guynemer, who has a record of twenty-seven victories over German flyers, Mathieu has been the most effective and relentless individual enemy that Germany has found in the air.

Some of the students at the Benoist School of Aviation, with Instructor Alys McKeys Bryant.

This indomitable bird-man was recently in this country on furlough, but sailed for home before America's request for the loan of his services was granted by France. Hearing that the necessary permission had been obtained, Mathieu turned back from his native land immediately upon his arrival in France.

It is understood he will be quartered on Long Island, where he will teach American flyers.

Army and Navy News

The following noncommissioned officers of the Signal Enlisted Reserve Corps are relieved from active duty at the Curtiss Aviation School, Newport News, Va., to take effect May 27, 1917, and will proceed to Ithaca, N. Y., for instruction at the Cornell University: Sergt. Oliver B. Sherwood, Sergt. Adna W. Gibson, Sergt. Alton A. Brody.

The Quartermaster Corps will furnish the necessary transportation and pay these soldiers commutation of rations in advance for the necessary number of days' travel, it being impracticable for these soldiers to carry rations of any kind.

First Lieut. Lawton V. Smith, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Fort Sam Houston, Tex., and report in person to the commanding general, Southern Department, for assignment to duty.

Capt. William C. Ocker, Aviation Section, Signal Officers' Reserve Corps, is announced as on duty that requires him to participate regularly and frequently in aerial flights from May 7, 1917.

Sergt. Thomas E. P. Rice, Aviation Section, Signal Enlisted Reserve Corps, is relieved from further duty at the Curtiss Aviation School, Newport News, Va., and will be sent to Boston, Mass., for instruction at the Massachusetts Institute of Technology at that place.

First Lieut. Lewis H. Brereton, Second Field Artillery, will proceed to Mineola, Long Island, N. Y., and report in person to the commanding officer, Signal Corps Aviation School at that place, for temporary duty, and upon the completion thereof will return to his proper station in this city.

Capt. Ralph L. Taylor, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Mineola, Long Island, N. Y., and report in person to the commanding officer, Signal Corps Aviation School at that place, for duty.

Sergt. George W. Wheeler, of the Signal Enlisted Reserve Corps, is relieved from active duty at the Curtiss Aviation School, Newport News, Va., to take effect May 27, 1917, and will proceed to Boston, Mass., for instruction at the Massachusetts Institute of Technology. The Quartermaster Corps will furnish the necessary transportation and pay this soldier commutation of rations in advance for the necessary number of days' travel, it being impracticable for this soldier to carry rations of any kind.

Under the provisions of section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt. Herbert A. Wardle on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, Memphis, Tenn., to take effect May 17, 1917, is confirmed.

Capt. Frank Page, S.O.R.C., son of Walter Hines Page, the American Ambassador to London, has been ordered to active duty and assigned to the office of the Chief Signal Officer as manager of cadet training. He will visit the Canadian aviation school at Camp Borden on June 2 to investigate the system in vogue there. Other recent details to General Squier's office include Capt. William Larned, S.O.R.C., who for several years was the national tennis champion; and Capt. R. B. Owens, S.O.R.C., until recently secretary of the Franklin Institute. Captain Larned has been assigned to the commission in the aviation section.

The second class in the Government Schools of Military Aeronautics matriculated on May 28. This second increment of 150 men brings the number of students now training for commissions as aviators to 300. They are apportioned to the six schools recently established at the Universities of Texas, California, Illinois and Ohio; Cornell University and the Massachusetts Institute of Technology. A new class will be admitted each week until a sufficient number has been obtained.

Each of the following officers will report to board at Aviation School, San Diego, Cal., for examination for rating as junior military aviators: Capt. Guy L. Gearhart, C.A.C.; 1st Lieuts. Thurman H. Bane, 8th Field Art.; Claude K. Rhinehardt, 17th Cav.; Norman W. Peek, Inf., D.O.L.; Thorne Deuel, Jr., Cav., D.O.L.; John C. Prince, Cav., D.O.L.; Harvery B. S. Burwell, 13th Cav.; Warren P. Jernigan, Cav.; John E. Rossell, Inf.; Norman J. Boots, 10th Cav., and William B. Peebles, Cav. (May 34, War D.)

The Department of the Interior authorizes the following:

Among the claims filed in the Bureau of Pensions on account of our present war is one by Susie A. Van Kirk, of Washington, D. C., who lives at 1450 Newton Street NE. She was the mother of Dean R. Van Kirk, who was an ensign and attached to the Naval Battalion, National Guard of the District of Columbia. He died on May 1, 1917, at Pensacola, Fla.

It is alleged that he was serving as a naval aviator and fell with his aeroplane into the Gulf and was drowned.

On account of the death of a person in the aviation service under the law the pension allowed to the wife, children, or dependents is double the amount of the ordinary pension under like circumstances.

Aviation School Squadron News

4th Aviation School Squadron, San Antonio, May 19, 1917—Six machines were received during the week at this school. Infantry drill with and without arms is held five days a week, from 7 to 11 a. m. and from 1 to 3 p. m.

1st Aviation School Squadron, San Diego, May 12, 1917—A total of 434 flights were made during the week, with a total duration of 239 hours 50 minutes. The officers received instruction in aero motors, motorcycles, construction and repair of airplanes and radio telegraphy. The enlisted men received practical work on aero engines together with military instruction.

1st Aero Squadron, Columbus, N. M., May 19, 1917—Some 40 flights were made during the week, with a total of 9 hours 19 minutes duration. Six machines of the type R-4 have been received.

The death of Capt. Ebarts, observer, occurred on May 15th at the conclusion of a flight.

Captain Mills left for duty at Massachusetts Institute of Technology, one of the college training schools for pilots.

It will be recalled there were nine aviation schools estimated in the Army appropriation bill. These are as follows:

Mineola, L. I. (Operating.)
Mt. Clemens, Mich. (Ordered.)
Fairfield, O. (Ordered.)
Ashburn, Ills. (Operating.)
Rentoul, Ills. (Ordered.)
So. Miss. Valley. (Under investigation.)
San Antonio, Tex. (Being established.)
San Diego, Cal. (Operating.)

The ninth is not yet located, but contemplated by the War Department to be in the Rocky Mountain region.

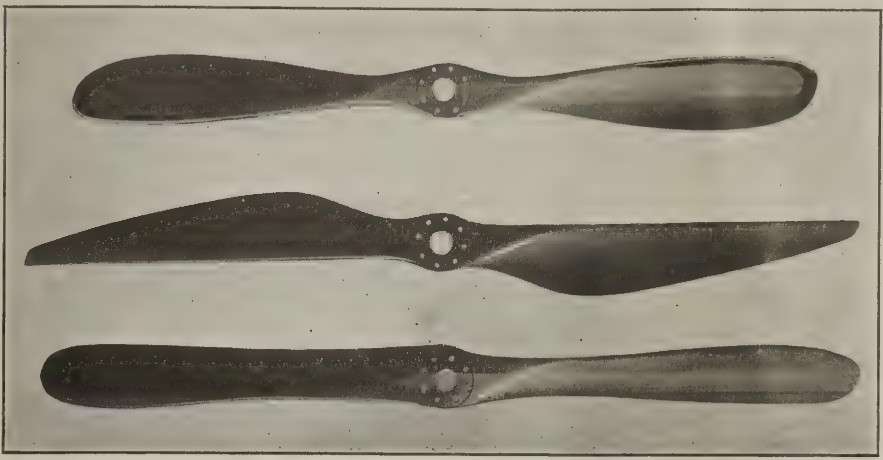
Other schools will doubtless be established as exigencies require.

The 1st Aviation School Squadron is now located at San Diego; the 2nd at Mineola; the 3rd and 4th at Ashburn.

The 1st and 2nd Reserve Aviation Squadrons are at Mineola and Essington, Pa., respectively.

Seven more squadrons are organized and on duty, as follows:

1st—Columbus, N. M.
2nd—Philippines.
3rd, 4th and 5th—San Antonio, Tex.
6th—Honolulu.
7th—Panama.



Aeronautical propellers manufactured by the Hall-Scott Motor Car Co., San Francisco.

The Walden-Hinners Company Organized

The Walden-Hinners Company has been organized and plans are being developed to construct various types of aircraft at the company's factory at Edgewater, New Jersey.

Mr. H. W. Walden, who will be the executive head of the company, is one of the pioneer aviators, being the third aviator in America to get his license on an original machine, having used the Walden monoplane. This was in 1908.

The factory is excellently located on the Jersey side of the Hudson River, and with the engineering skill which the Walden-Hinners Company have secured, the organization ought shortly to be in a position to substantially help the Government to equip the large air fleet in prospect.

THE RICE DIRIGIBLE AIRSHIP

With so much attention centered upon the question of dealing with the "submarine menace," closer consideration is being given to the employment of aircraft in spotting and destroying submarines. Aeroplanes have been used extensively in Europe for this work, for from above it is possible to discover a submarine which is submerged to a depth of twenty-five feet. Upon sighting a submarine the aeroplane observer signals to the patrol boats which are rushed to the spot indicated, or if the observer carries a machine gun or bomb-dropping apparatus he takes a shot. The latter procedure, to be effective, requires expert marksmanship, for the aeroplane must fly at a speed of not less than 40 to 45 miles an hour.

A type of airship which may prove effective in coast patrol work has recently been brought to the attention of authorities interested in checking the activities of the submarine. This airship, designed by Messrs. J. T., J. A. and R. A. Rice of New York, is of such a nature that it can be brought to a full stop directly above a submarine, descend to within a few feet of the water, if necessary, and release explosives or fire projectiles straight down upon its object.

For steering in ascent, descent and direction, it relies solely upon it propellers which are caused to exert a thrust in any direction desired. Six propellers are employed; one at forward end of frame, one at rear, and two at either side. Front and rear propellers operate in an arc horizontally of 180 degrees, and steer the machine to right and left. Turning both these propellers to one side will move the airship sideways.

The four side propellers operate in an arc vertically of 360 degrees, and are for the purpose of ascending and descending. They may be reversed to move the machine backward. They may also be set to restore balance and overcome the effect produced by the contraction or expansion of the hydrogen gas, or the accidental loss of a compartment of gas from the balloon.

All six propellers are used for driving straight ahead. Engines of 50 horsepower each drive front and rear propellers, and a 100 horsepower engine is provided for each of the two pairs of side propellers.

The airship is the semi-rigid type. Hydrogen gas capacity about 274,348 cu. ft., capable of lifting more than 18,108 lbs. Overall length of balloon, 250 feet; diameter 45 ft.

The framework under the envelope is V shape, with a passage through its center for its entire length. At the middle it is widened to form the car. The construction of the frame is of a truss type, making a very rigid structure, evenly distributing the load to insure proper balance. Length of framework, 175 ft. with a 16 foot extension at each end, making the total overall length of the frame 207 ft. Height, 9 ft.; width, 20 ft. Where side propellers are located there are 4 foot extensions, making the total width at these points 28 feet.

A speed of approximately 40 to 50 miles an hour has been calculated for the airship, with sufficient fuel for a forced run of 16 hours or a cruising radius of nearly 24 hours.

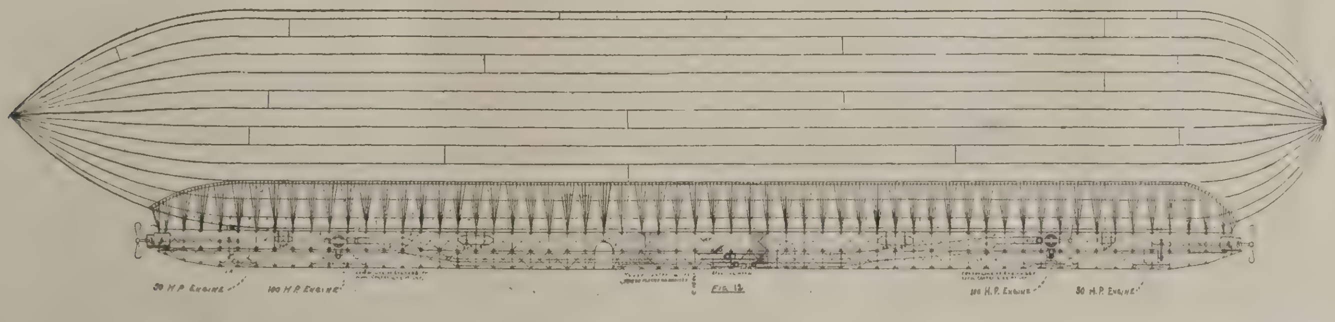


Fig. 12

STANDARD TWIN-MOTORED HYDROAEROPLANE

THE Standard Aero Corporation has practically completed the giant battleplane shown in the illustration below, and by the drawing on the opposite page. This hydro battleplane weighs 2½ tons, and is said to be larger than any now in use on the allied fronts. Machine guns are mounted over the pilot's and observer's seats, and in every way it is a typical bomb-dropping battleplane, with a range of action of 450 miles at economical speed.

One more step, the covering of the wings, will complete it and make it ready for shipment to a district where its effectiveness will be quickly shown. With the extensive facilities for manufacture and the usual carefulness with which previous Standard products have been worked out, a high rate of efficiency is expected both in production and performance.

General Dimensions

Span, upper plane	69′ 2″
Span, lower plane	54′ 1″
Chord, both planes	7′ 0″
Gap between planes	7′ 0″
Overall length	33′ 4″
Overall height	12′ 5″
Net weight (empty, without fuel but with water and accessories)	3520 lbs.
Gross weight (fully loaded)	4850 lbs.
Speed range, full load	45-80 m.p.h.
Climb in 10 minutes	3400 feet
Gliding angle	7½ to 1
Motors, Hall Scott (each 140 H.P.)	280 H.P.

Planes

Angle of incidence, 5°. Dihedral angle, 3%. No sweepback or stagger. Wing curve of upper plane, R.A.F. 6; lower plane, the new curve evolved by the Government, known as the "U. S. A. 2."

Upper plane in 5 sections; middle section 15′ 0″; main sections each 15′ 6″; overhanging sections each 11′ 6″. Gap between sections, in every case 1 11/16″. Wing tips raked at an angle of 10°.

Lower plane in 4 sections; middle sections projecting from fuselage 6′ 0″; outer sections each 20′ 0″. Space between middle sections and fuselage, 2″; fuselage at this point is 32″ wide.

Area, upper plane, including ailerons, 467 sq. ft. Lower plane, 349 sq. ft.

Ailerons 16′ 0″ long are attached to upper plane. Each has a surface of 43 sq. ft.

Front struts 8½″ from leading edge; rear struts centered 49 13/16″ from forward struts.

Body

Width, 32″; maximum height, 3′ 0″. The nose of the body extends 7′ 4″ forward of the centers of front wing struts.

The observer's seat, situated forward of the planes, gives an advantageous location for observation and the operation of a machine gun. The pilot's cockpit is just below the trailing edge of the upper plane, a portion of the latter being cut away to permit of vision upward and to allow of easy access to the seat.

Single Deperdusin control is installed, although dual Dep is provided on special order.

Two pairs of inverted V steel tube struts support the upper plane above the body, and from the apex of each attachment is made to a sling by means of which the machine may be hoisted by a crane. In the drawing the sling is shown in an extended position.

Tail Group

The tail or horizontal stabilizer has an area of 62 sq. ft. Elevator area, 32 sq. ft. In the elevator there are two openings to allow for the movement of the rudders.

Vertical fins or stabilizers in four sections, two above and two below the tail plane, with a total area of 16 sq. ft.

Two balanced rudders are attached to the trailing edges of vertical fins. Each has an area of 10 sq. ft.

A tail float is carried at the fuselage extremity.

Pontoons

Twin pontoons are each 3′ 0″ wide, 2′ 0″ maximum height, 16′ 4″ long. A step occurs 5′ 0″ from the heel of the float. Floats centered 12′ 0″ apart.

Steel supports, with streamline faring of spruce, provide bracing from the floats to the fuselage and to the motors.

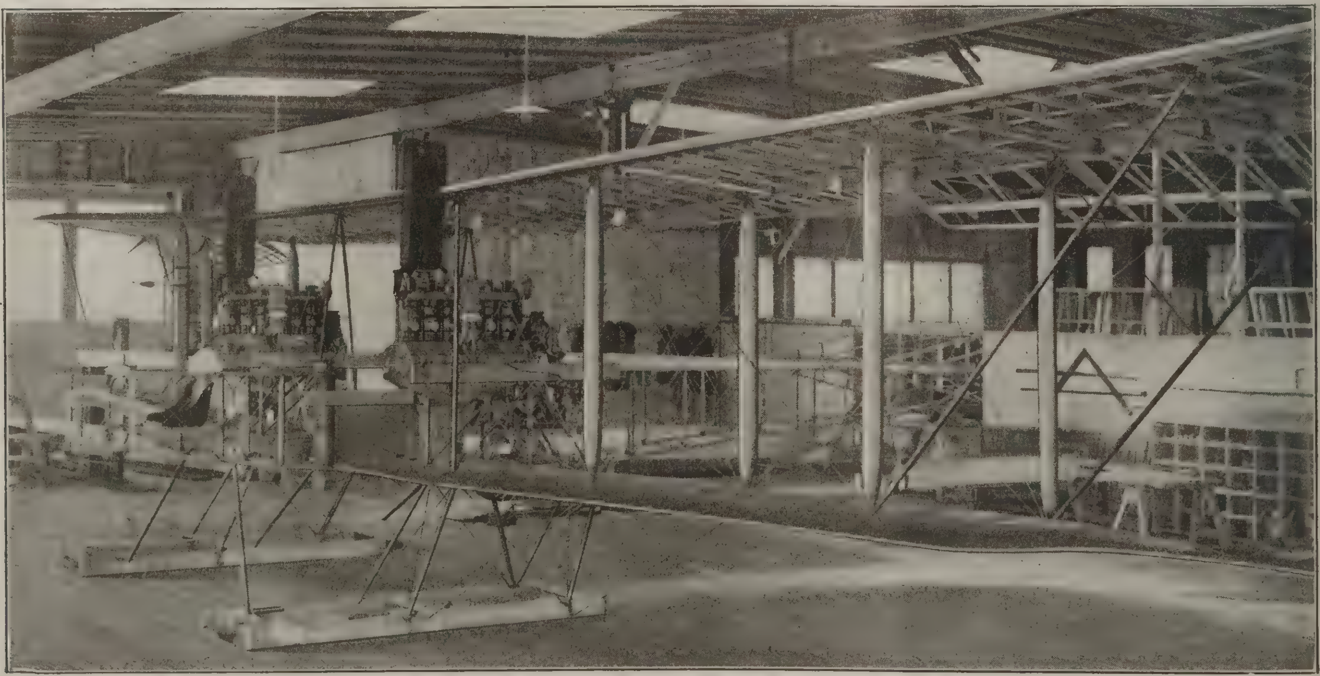
Motor Group

Two Hall-Scott "A-5a" motors are carried between the planes. The "A-5a" is 6-cylinder, vertical, fourstroke cycle, water cooled, rated at 140 H.P. at 1350 r.p.m. Bore, 5¼″; stroke, 7″. Weight, 605 lbs. Each motor consumes about 30 gallons of fuel per hour. Oil capacity in crank-case of each motor, 5 gallons.

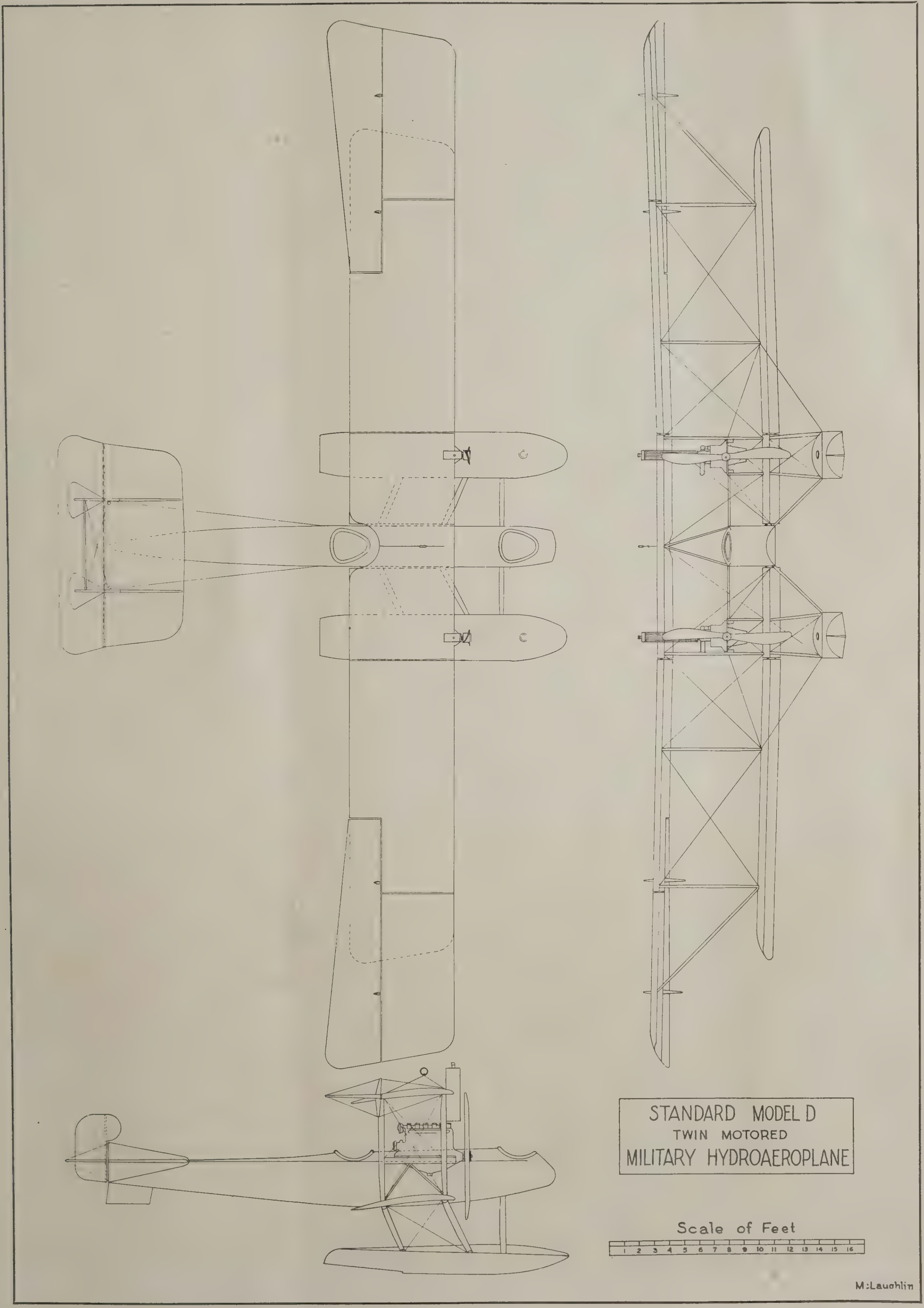
Vertical radiators are carried above each motor; sections of the leading edges of upper wing are cut away to permit secure anchorage of the radiators to forward main wing beam.

Propellers are of "Standard" make, material of black walnut. Viewed from pilot's seat the left propeller rotates in a clockwise direction, and the right propeller counter-clockwise.

Tanks have a capacity for 154 gallons of fuel.



Standard Twin-Motored Hydroaeroplane



STANDARD MODEL D
TWIN MOTORED
MILITARY HYDROAEROPLANE

STANDARDIZED AEROPLANE HANGARS

REALIZING the steadily increasing demand for permanent and durable buildings for sheltering the various classes of aircraft, the Steel Fabricating Company, of Chicago, has designed and standardized an all-steel hangar.

On the opposite page is shown a diagram of the two standard types or sizes of hangars this company is manufacturing, and also a photograph of a hangar furnished to Mr. W. Earl Dodge's aviation school at Jackstonville, Florida. The buildings, which are built entirely of steel, are designed upon approved and accepted principles of engineering. They are strong and durable, easily and quickly erected and are in every sense of the word, fireproof structures. This latter feature appeals very strongly to aeroplane owners.

The building is supported by heavy steel columns, alternately arranged so that the space inside may be used to the best advantage for sheltering the aeroplanes. The roof sheets are attached securely to the steel purlins and the latter bolted to the roof trusses.

Curtains of either canvas or steel may be provided to enclose the open side of the building. In the event steel curtains are desired, the company can furnish a top-rolling steel door in place of canvas curtains. These doors, which roll upward, are supported by steel columns fitted to a track at top and bottom which, when the doors are rolled up, slide to one side of the building and thus permit the aeroplanes to pass either in or out of the building without difficulty. Several aeroplane manufacturers have found it advisable to request their customers to use steel hangars for housing their planes.

While designed for permanent structures, these hangars have the added feature of portability. All material necessary for the erection of any size hangar is kept in stock and all parts being standardized can be shipped on short notice. Standard units, or sections to make additional length to accommodate one or more aeroplanes, may be supplied at any time.

The engineers of the company have spent the better part of a year in designing and testing the hangars and have combined their ideas with those of several manufacturers of aeroplanes and feel that the buildings are constructed on substantial and economical principles.

Specifications for a Standard Aeroplane Hangar

56′ x 44′ and 48′ x 44′ Units

General: The following are the specifications for Standard Aeroplane Hangars in 56′ x 44′ or 48′ x 44′ units, the height of these units being 14′ 6″ in the clear underneath of lowest portion of roof trusses.

These hangars are arranged with two rows of supporting columns, the roof span between which across the building is carried by means of a 24′ truss with a cantilever truss projecting 10′ beyond the columns on each side of the building, making a total width of the building of 44′ 0″. The columns lengthwise of the building are spaced either 48′ or 56′ centers. The columns in the front of the building and those in rear of the building, not being opposite each other, but being arranged alternately so that the column on each side of the building comes approximately at the center of the space between columns on the other side of the building, thus allowing an economical use of the entire space by aeroplanes as indicated by the plans.

The first unit of 56′ or 48′ will accommodate one aeroplane; for each additional unit there will be accommodated two additional aeroplanes.

The roof covering will be of corrugated steel and also the ends of the building will be sheeted with the same material, excepting the end trusses, which will be covered with flat sheets.

The corrugated roofing will be supported by angle iron purlins on the steel trusses. The steel trusses will be supported by steel columns with the proper bracing to take care of wind pressure, the columns being guyed with steel wire cables.

Steel Framing for Roof: The corrugated roof sheets are to be attached to steel purlins which are to be bolted to steel roof trusses. This work to be done in the field.

(Trusses)—The trusses are built up of steel angles with riveted connections, excepting the joint at middle of truss, which is to be bolted together in the field, the truss being shipped in two sections so as to reduce crate size. The size of the truss members are shown by the detail drawings.

(Purlins)—The purlins at ridge and the intermediate purlins on each slope of roof are built-up sections of two angles riveted together as shown.

The roof sheets rest on top of the exterior wall sections without the use of a purlin at that point.

Wind Bracing: Two continuous struts extend the length of the building between lower chords of the 24′ trusses. Diagonal bracing is provided between trusses and these struts as indicated, and also 1′ rods with turnbuckles between columns as indicated by the plan to transmit the wind bracing to the columns. These columns are in turn guyed by means of cast steel guy-ropes to proper anchors in the ground. These guy-ropes are used so as to decrease the size of the steel columns.

In addition to this bracing there is also diagonal bracing in the plane of the upper chord at intervals throughout the length of the roof, and the main supporting columns of trusses at each end of the building are to be guyed to take the wind pressure on the end of the building in a manner similar to the guys provided for each column as before described.

Steel Framing for End Walls: The end walls of the building will be framed with steel I-beam columns, to which will be attached steel angle girts similar to the steel purlins shown. The sheeting for end walls will be applied in a manner similar to the sheeting for roof as described below.

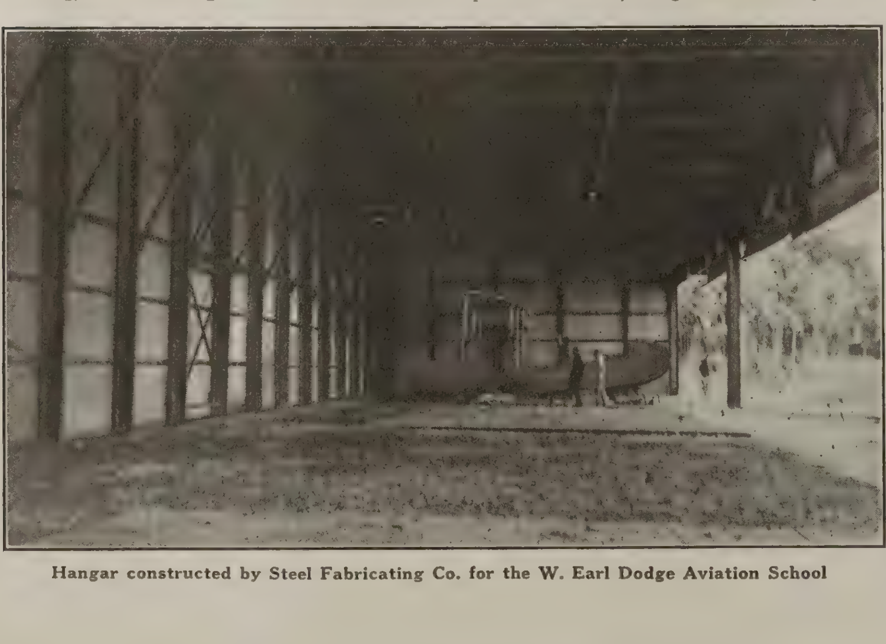
Corrugated Steel Roofing: The corrugated steel roof sheets will have steel clips attached to same at the factory, there being two clips per sheet at each purlin. These clips will hook under the flange of angle purlin, the clips at ridge secured to sheets by a single rivet and the clip turned around under flange of angle so as to lock the last sheet in position. All roof sheets shall lap one and one-half corrugations at side with 6″ end lap.

Ridge Roll: A ridge roll with corrugated lap over roof sheets fitting closely to same will be provided as shown. This ridge roll to be fastened in place in the field by means of clips attached to it, being turned under purlins.

Curtains: Curtains of regulation material will be provided to enclose each side of the building. These curtains to be of proper width so that they may be handled readily, and shall be provided with proper roll and means for raising and lowering same. Proper means for securing curtains to ground when same are closed shall be provided. Curtains will be arranged to lap a sufficient distance to make same reasonably weather tight.

Painting: All steel work, including roof and wall sheets, angle iron trusses, purlins, columns, bracing, etc., will be given two coats of paint of approved quality at the shop.

Quality of Steel: All steel angles for framing throughout will be rail carbon steel; all guy-ropes shall be of cast steel wire; all roof sheets and tie rods shall be of medium steel; roof and wall sheets shall be plain or corrugated as indicated by the drawings; all sheet steel shall be No. 24 gauge galvanized.



Hangar constructed by Steel Fabricating Co. for the W. Earl Dodge Aviation School

Americans to Make "Birdseye" War Maps

Captain John Dewar Irving, professor of cartography at Yale, will command a unique unit of the 1st Engineers Reserve Regiment when that organization goes to France. Known as "skyographers," their duties will be to analyze "birdseye" photographs taken from scout aeroplanes and to make strategic maps from them.

The practice of drawing maps from photographs of sections of the battlefield has been of great use to commanding officers on French fronts. From the scout aeroplanes it is possible to see the lines of trenches and their communications throughout a large district, and so highly has the science been developed by the French that the actual number of enemy troops and supplies has been worked out from photographs.

Taking Recruits for Second Reserve Aero Squadron

New York.—Col. Hartmann, Signal Officer for the Eastern Department, announced that recruits are now being accepted in New York and Philadelphia for the Second Reserve Aero Squadron. The first squadron still can use fifteen first class mechanics. Forty men of this squadron already have gone into camp at Mineola. Cooks and privates, in addition to gas engine experts, now are needed. The chances of getting to France in it quickly are good. Applications of those who want to be aviators are sent to the Chief Signal Officer at Washington.

Plan Village for Joy Field

Detroit.—The Joy aviation field near Mt. Clemons, Mich., which has just been purchased by the Government from H. B. Joy, has witnessed considerable activity during the last few days. Plans are being arranged to expend the $1,000,000 which the Government has appropriated to fit this land for aviation work.

This aviation school is one of nine which the Government will build in various parts of the country.

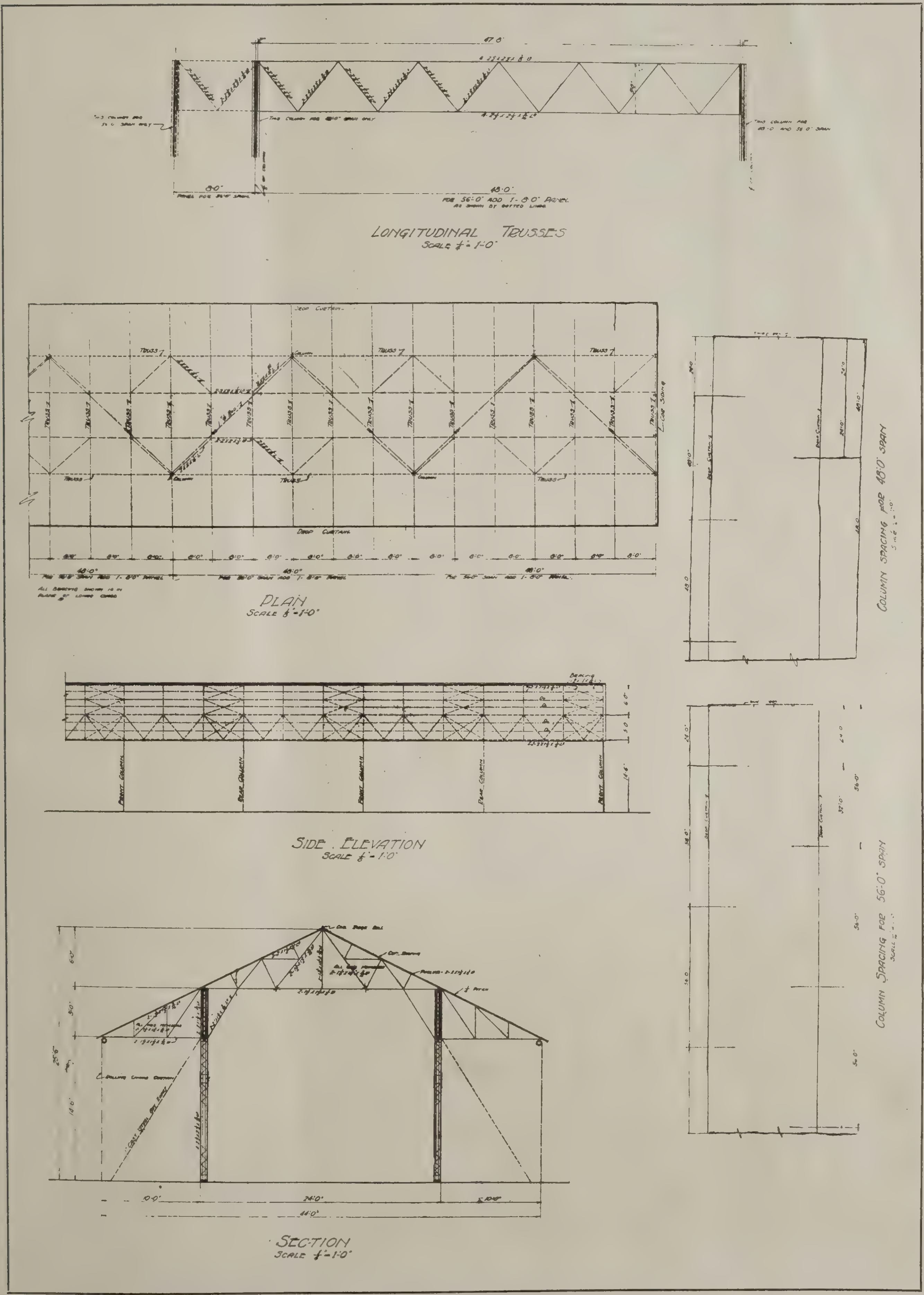
Aeroplanes and seaplanes will be tested on these grounds. Even a church will be located on the property. The Government has purchased 1,700 acres for the village, which will have approximately 1,000 inhabitants at the start. It will be permanent.

The school at Mt. Clemens is to be a one-squadron plant. There will be twelve hangars, 60 by 60 ft., each with a capacity of twelve machines. There will be six barracks, each with a capacity of 150 men, with the necessary mess halls for both officers and men.

Officers' quarters, quarters for the non-commissioned officers, a house for the commanding officer and a club house are among the buildings called for in the plans. There will be thirty-six officers. While the buildings will be only semi-permanent, they will be modern in every way, especially as to the plumbing. All will have baths with showers in the barracks.

The school, with numerous class rooms and rooms for instructors, will be about 60 by 200 feet. It this the future flyers will be taught the technical side of their profession. Included among the buildings are a machine shop, an aero repair shop, a supply department, quartermaster's department and a guard house. The non-commissioned officers' quarters will house twenty-four men.

A hospital, blacksmith shop, heating plant, water supply and sewer will be constructed also. The buildings, which will be of one-story type, will be of frame on concrete foundation. They will cost in the neighborhood of $600,000, and the other equipment wil bring the cost to a full million.



Standard Aeroplane Hangar, Manufactured by the Steel Fabricating Co.

THE GERMAN AEROPLANE ENGINE TRIALS

(Continued from page 76)

In the following pages are given a few details of the more interesting engines that took part in the competition. Of course, the engines concerned are not for the most part now in use, but some of the features are of present interest, and certain comments may be made.

Naturally, the most interesting engine is the one that won the first prize, the 100 h.p. four-cylinder Benz. The general appearance of this, shown in figure 1, and the line drawings figures 2, 3, and 4, will make clear the chief constructional points. The bore and stroke were 130 and 180 mm. respectively, and in the report of the trials it was stated that these dimensions resulted in a good shape of combustion chamber, and an extremely light engine. As a rule, it is generally assumed that a long stroke engine must necessarily be heavier than one of equivalent capacity with a shore stroke and large bore. However, this may be, the Benz won the first prize chiefly on the score of its small weight, which worked out at 345 pound for 101.2 h.p.; its petrol consumption was extremely low, this working out at .53 pint h.p. per hour. One of the objections to a very long stroke was removed by off-setting the crankshaft a distance of 20 mm., as is clear from figure 4.

It will be noticed that the shape of the engine is very good, in that it is narrow and more or less of streamline form. The accessories are mounted very close in to the crank chamber, and attention may be directed to the situation of the magnetos. The driving gears are located, as can be seen in figure 3, inside the crankcase, so that the magnetos can be brought much closer up than usual. At the same end as the magnetos is a vertical spindle driving the oil and water pumps, and as all these accessories have been arranged at the back of the engine, they are therefore comparatively accessible.

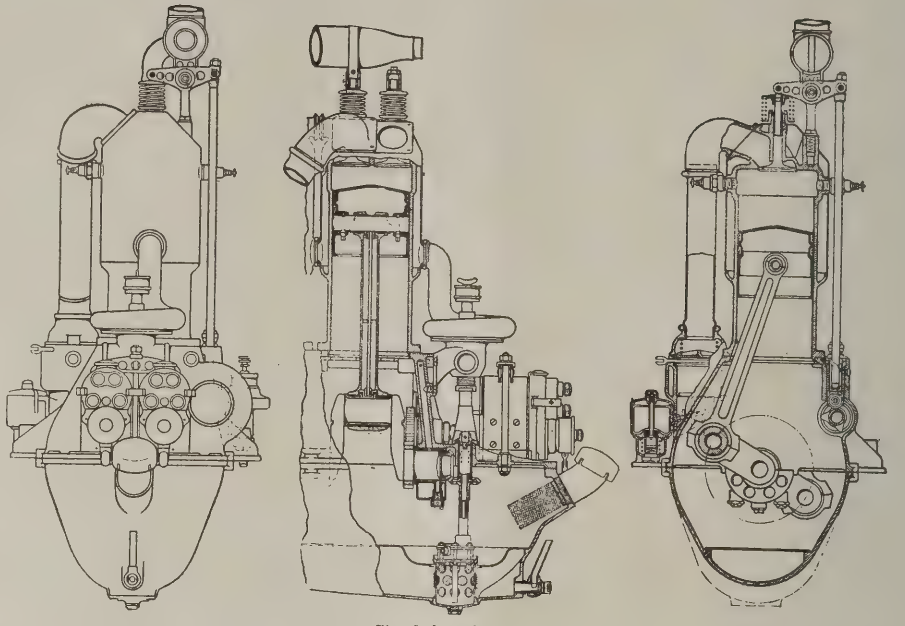
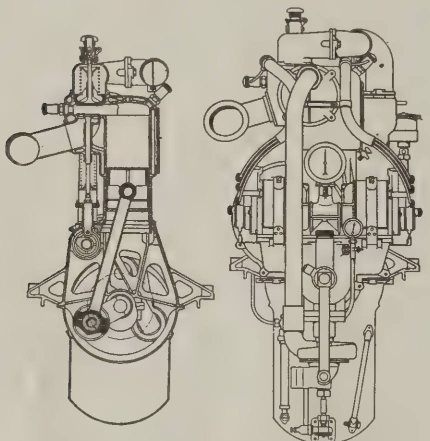


Fig. 2, 3, and 4.



Figs. 16 and 17.
Six-cylinder Mulag engine, 90-113 h.p., bore and stroke 110×170, speed 1,346 r.p.m., weight 482 lb.

The cylinders are of cast iron machined all over, outside as well as inside, and also around the valve pockets, whilst the jackets are of sheet welded to flanges on the cast iron cylinder. The mounting of the carbureter is particularly interesting, as the throttle chamber is cast in the crank case, and is therefore kept fairly warm. Furthermore, the air entering the carbureter is drawn through passages across the crank case, thus warming the air and tending to lower the temperature of the oil—a practice that is adopted on the present-day Zeppelin engines. All gas and water joints in the piping are made by rubber rings, which were found to be perfectly satisfactory.

As regards lubrication, there were two systems, one in which the oil used was recirculated to the various parts, and a second whereby fresh oil was supplied to the bearings, and the two systems were independent, so that if one failed the supply from the other could be relied upon.

It will be seen that the overhead valves were actuated by push rods and rockets, and, of course, an engine such as this is not suitable for extremely high speed. The Germans seem to have marked partiality for push rods, or certainly did so until fairly recently, as a similar construction is used on the Austrian Diamler engine, although this system does not necessarily represent the most approved practice. The best type of actuation of overhead valves is somewhat debatable, but on the whole the overhead camshaft is probably best.

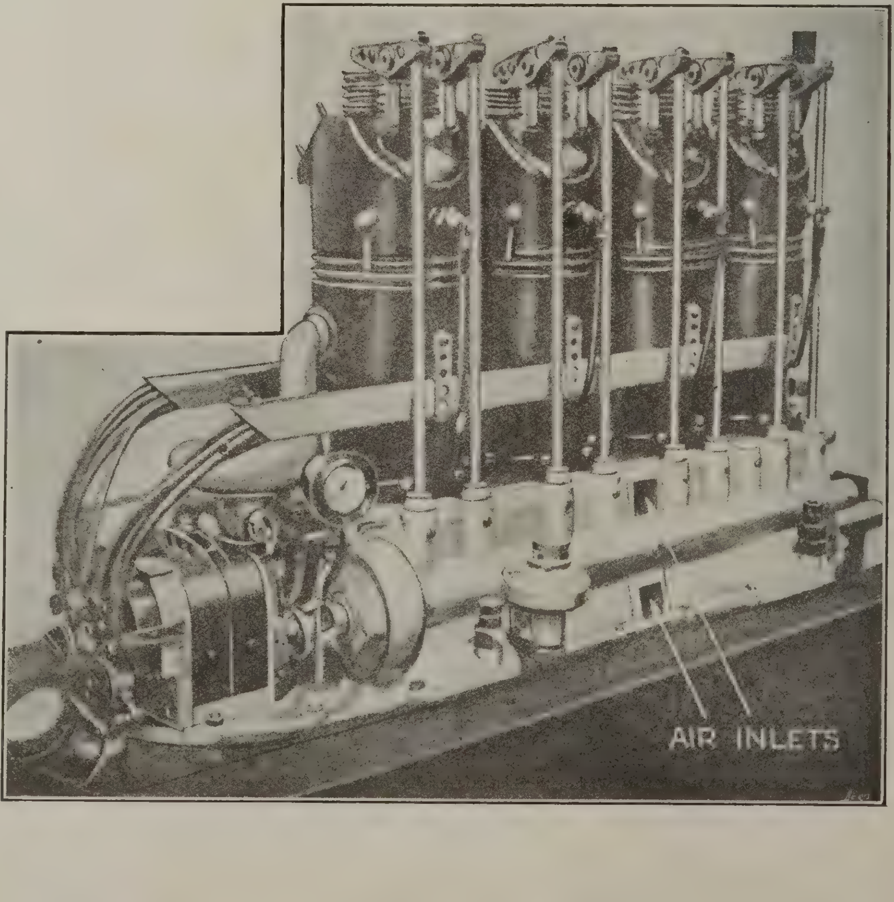
The valves are vertical, and as can be seen from figure 4, the stems are of two diameters working in guides which are only partly bushed. In other cases the valve guides were devoid of bushes in order to reduce as much as possible the thickness of metal between the valve stems and the cooling water. The idea of making the valve stem of two diameters is to facilitate its removal. The valve rockers were mounted on ball bearings to eliminate sticking, which is, otherwise, a common defect.

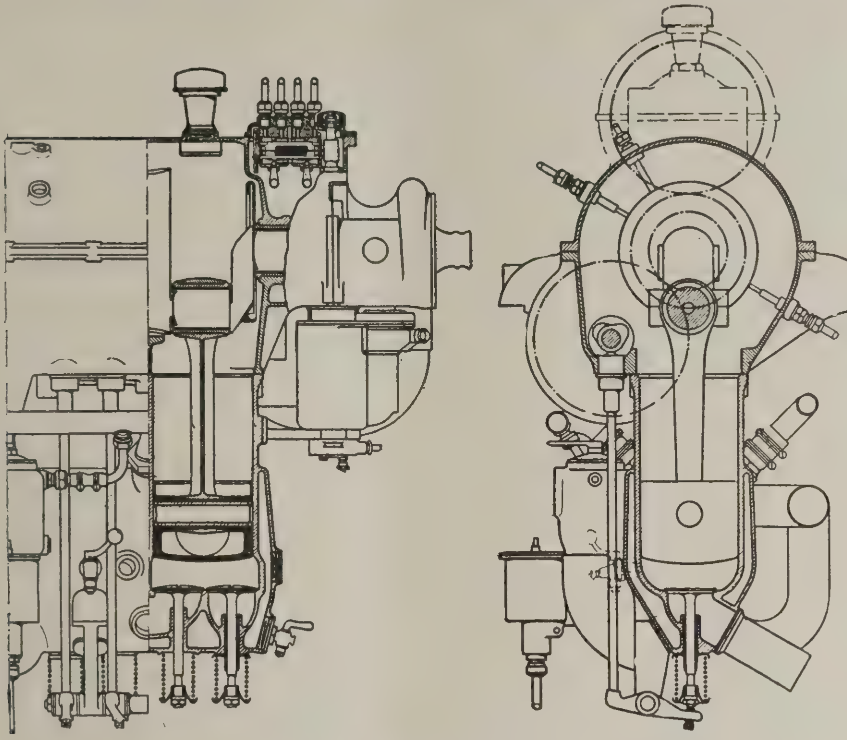
The pistons were fitted with four rings, two in each groove, and during the sixteen hours of full load running in the tests maximum compressions was retained throughout—a point that reflects creditably on the design generally.

The Daimler Motoren Gesellschaft entered seven engines of different types, representing successive models, commencing with an old pattern of 50 h.p. with exposed timing gear and overhead valves actuated by push rods and rockers. The next was a 65 h.p. four-cylinder engine so as to leave one end free for the propeller and the other end for the magnetos, etc.

Later types of engines followed with overhead camshafts, of which the smallest was the 90 h.p. with four cylinders. The smallest six-cylinder model was the 95 h.p., but this engine showed a greater weight per h.p. than the four-cylinder models, but, of course, possessed the advantages of more even torque and better balance. Two carbureters were used, and consequently the petrol consumption was comparatively heavy.

The most interesting model was the 65 h.p. four-cylinder inverted engine, which is shown in figures 5 and 6. The object of suspending the cylinders from the crank case is mainly not to interfere with the range of vision of the aviator, but other advantages are the lowering of the centre of gravity of the engine, and improved cooling, as the cold water is admitted





Figs. 5 and 6.

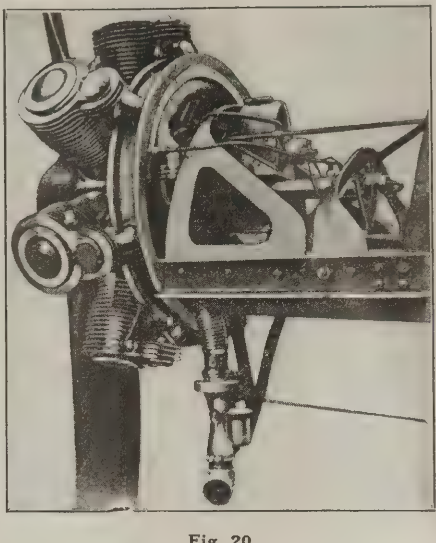


Fig. 20.

at the lowest part of the cylinders around the valve pockets and steam bubbles have a free passage away from the cylinder head. Another important feature is that the exhaust is carried away underneath the machine. Against these merits no pronounced disadvantages were discovered. With regard to lubrication, the top half of the crank-chamber, instead of forming a sump as it does in an ordinary engine, was merely a cover, and the oil was supplied through a distributor to all the various bearings and cylinders. Fresh oil was admitted all the time, as there was no means of providing for the collection of used oil and recirculating it again. The water pump is driven off the rear extremity of the crankshaft, and the magneto was slung beneath the shaft. Althought it might be supposed that trouble would be experienced with ignition, owing to the oil reaching the sparking plugs, this was not found to be the case. On account of its various merits, this engine received the fourth prize.

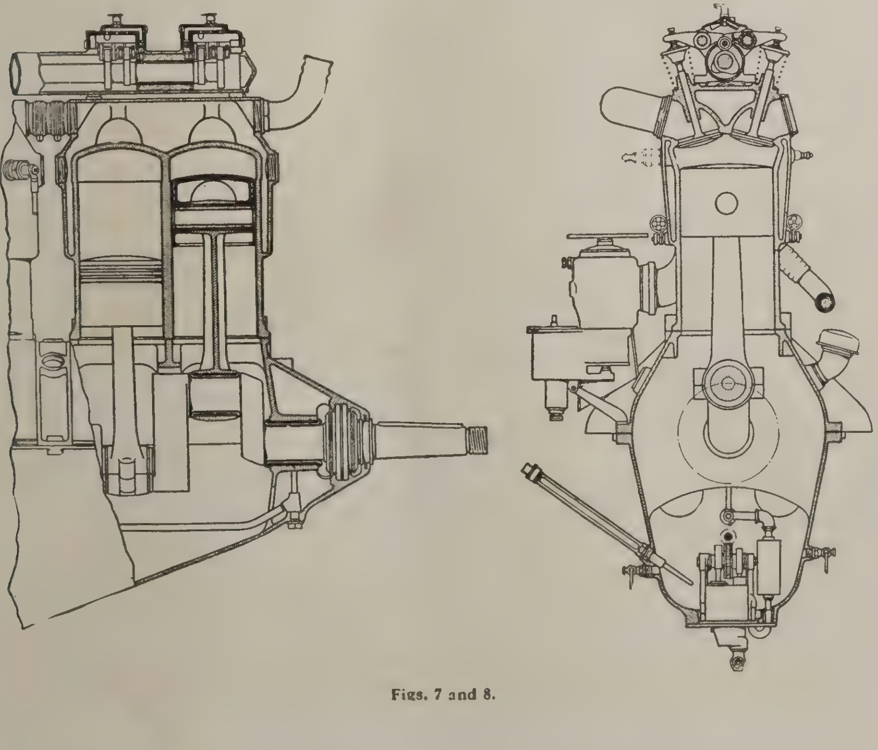
Another inverted engine was entered by the Mercédès Company, and this had the propeller fitted to a separate shaft driven through a reduction gear. It is shown in figures 7 and 8. Unfortunately, this engine did not take full advantage of the reducing gear in the direction of raising the engine speed and thereby reducing the weight. Contrary to expectations, it was not found necessary to fit a flywheel on the crankshafts of these engines with reducing gears.

Figures 7 and 8 show some of the features of the 90 h.p. six-cylinder Mercédès which carried off the second prize. The main interest in this engine lies in the steel cylinders, one of the advantages of which is that the wall between the jacket and the combustion chamber can be made much thinner than with cast iron, and therefore higher pressures can be used without fear of pre-ignition. Whereas the average mean effective pressure in the best of the engines with cast iron cylinders was 108 pounds per square inch, with this engine having a higher compression the m.e.p. was 114.2 pounds per square inch. The cylinders were constructed in pairs out of a single billet machined inside and out. This engine not only won the second prize, but subsequently broke the world's record on a duration flight with passenger, after which the engine was dismantled and the cylinders were found to be in extremely good condition without any signs of scoring. The natural virtues of a six-cylinder engine in the direction of balance and continuity of torque proved to be particularly advantageous, which is obvious from a consideration of later engines.

The third prize was awarded to the makers of the N.A.G. engine. Two different types were entered, both with four cylinders, of which the larger was the more recent type. The smaller engine, figures 9 and 10, was based upon the one used by the Wright brothers, the only interesting feature about which was the crank-chamber construction. This comprised a single casting with an opening at one end through which the crankshaft was inserted. The oil consumption of this engine was extremely low. The larger engine, which is illustrated in figures 11 and 12, was of compact and neat appearance, but there was nothing very noteworthy in the design. The cylinders in both cases were of cast iron machined outside as far as practical, and the water jackets were of copper held in place by spring rings.

A longitudinal section of the Argus engine is shown in figure 13 and a cross-section in figure 14. This engine possesses a number of somewhat striking features, the chief of which is probably the shortness of the water jackets, which naturally resulted in a correspondingly small radiator. Some reliance had to be placed upon air-cooling of the cylinder walls, and for this purpose the outside of the cylinder was machined. Another striking feature is the small depth of the crank chamber. The lubrication system was very crude, being merely splash stirred up by the cranks dipping into the oil in the bottom of the crank-chamber. The design in many respects is poor.

A somewhat startling design is that of the Mulag engine shown in figures 15, 16 and 17. For some reason not stated the crankshaft was extended very considerably at the front. This and the very deep sump made the overall dimensions very considerable. The valve springs and tappets were enclosed by telescopic aluminum tubes which served as crankcase vents and re-



Figs. 7 and 8.

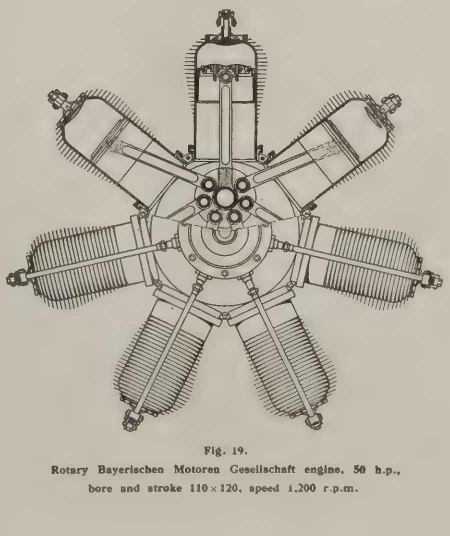


Fig. 19.

Rotary Bayerischen Motoren Gesellschaft engine, 50 h.p., bore and stroke 110 × 120, speed 1,200 r.p.m.

tained oily vapor in the neighborhood of the valve stems.

In the engine entered by Basse and Selve the only striking feature was the fact that aluminum alloy was used for the bolts, nuts, and screwed couplings. These parts stood up to their work quite satisfactorily.

On one four-cylinder engine the cylinders were in pairs with a comparatively large intervening space between the two blocks. In the central space was a gearing which drove upwards through a bevel-driven shaft on to an overhead camshaft. Alongside this vertical shaft was a transverse one, driving two magnetos. In this case both ends of the crank-chamber were free of accessories, and the magnetos were brought high up and rendered very easily accessible.

Of the rotary air-cooled engines, that of the Bayerischen Engine Co., figures 18 and 19, was the most interesting. The main construction resembles the Gnome, as the mixture passes through the crank-chamber, via automatic inlet valves (of which there are two, in distinction to one in the Gnome), into the combustion chamber. In the engine entered by the Kruk Motor Co., figure 20, there was a single compound valve which served both for inlet and exhaust, operating in conjunction with a distributor, and both these functions were therefore mechanically controlled.

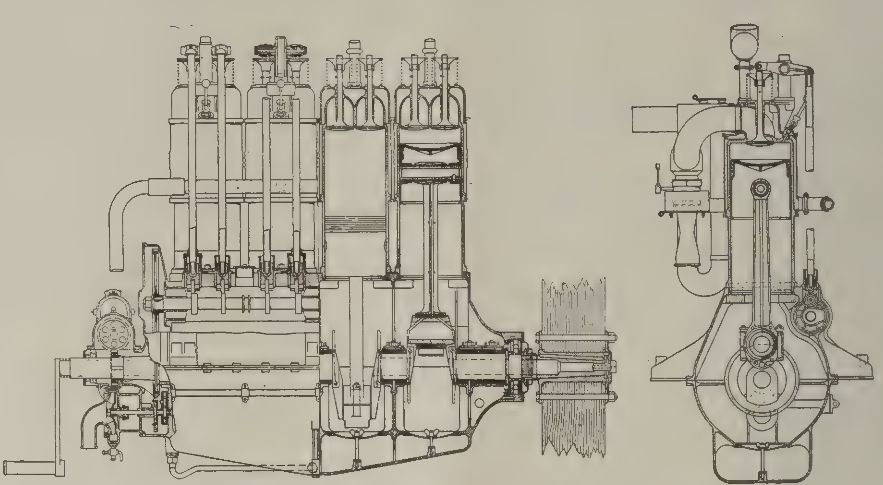
As stated previously, the air-cooled engines did not distinguish themselves, partly on account of the fact that the conditions of the trial did not suit this type, in which the fuel and oil consumption must necessarily be heavy. Further, these air-cooled engines experienced a certain amount of misfortune.

The majority of the carbureters used were of the G.-A. type, in which there is a single jet and a number of air ports of different sizes, each sealed by a ball of corresponding size, the balls lifting progressively. It is interesting to note that this type of carbureter has now been discarded generally.

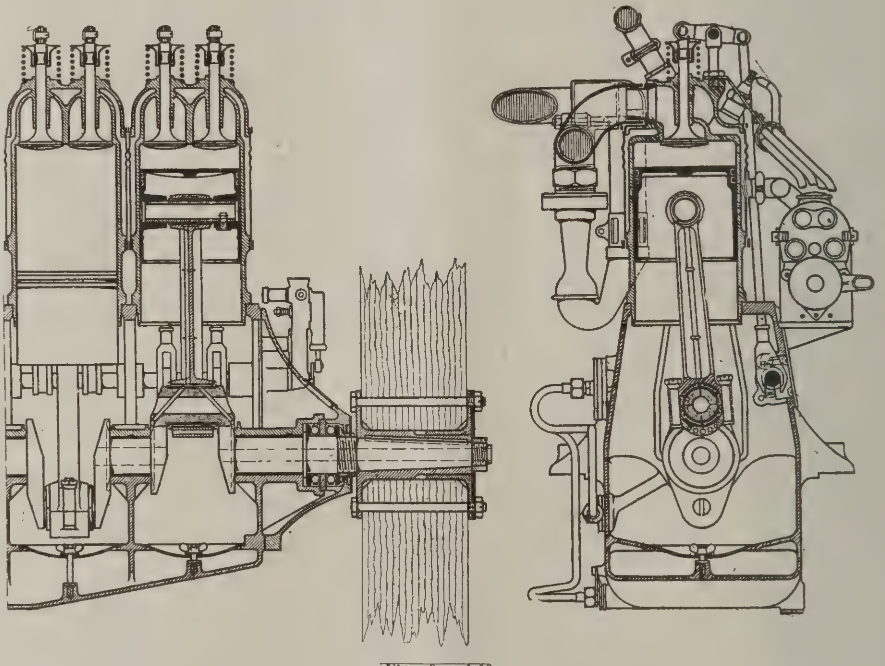
It will be gathered that the results obtained from the air-cooled engines were disappointing, chiefly in view of the small number of entries. The stationary air-cooled engine was not represented, which is particularly unfortunate in view of the popularity of this type. The rotary engines which were entered did not do very well, but a present day trial in which rotary and stationary air-cooled engines were in competition with water-cooled stationery engines would be extremely interesting.

The chief merit of the air-cooled rotary engine is, of course, the ease of attachment and removal and small weight of the plant, but the latter is discounted, when a flight of any length exceeding two hours is considered, by the large quantity of fuel and oil which must be carried. A secondary advantage is the big flywheel effect, which gives steadier running and steadier flying in gusty weather. With the more conventional type a sudden gust of wind may almost stall the engine, or at any rate reduce its revolutions and thereby the power.

In the Gnome air-cooled engines the fresh charge passes through the crankcase and enters the combustion chamber through inlet valves in the piston heads. In this way the crank case and lubricating oil and the piston are cooled, but at the same time the piston weight cannot be particularly small. Contrary to what one would imagine, the piston weight is important and the design difficult owing to the side pressure on the cylinder walls. This side pressure, which is very large is due to the tangential acceleration and retardation. When the piston is at the bottom of the cylinder its circumferential velocity is small. From this point until the piston reaches the outer dead centre the circumferential velocity has to be very rapidly increased, resulting in a very large tangential pressure on the side of the cylinder, due to inertia of the piston. Correspondingly on the down-

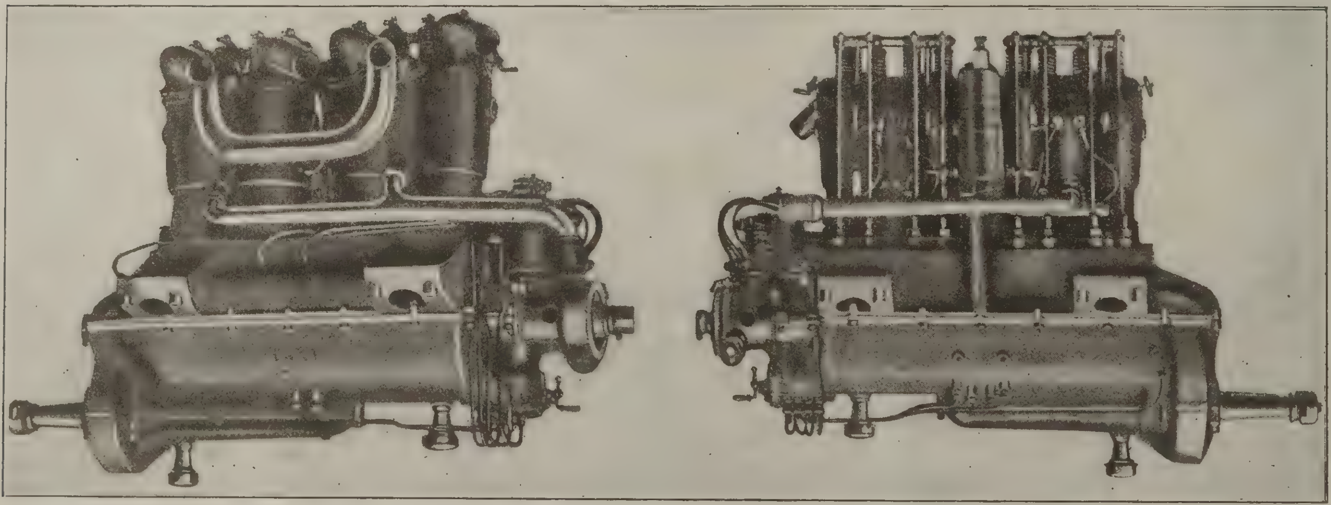


Figs. 11 and 12.—Four-cylinder N.A.G. engine, 94-97 h.p., bore and stroke 135 × 160, speed 1,344 r.p.m., weight 400 lb.



Figs. 9 and 10.

Four-cylinder N.A.G. engine, 55 h.p., bore and stroke 120 × 120, speed 1,408 r.p.m., weight 235 lb.



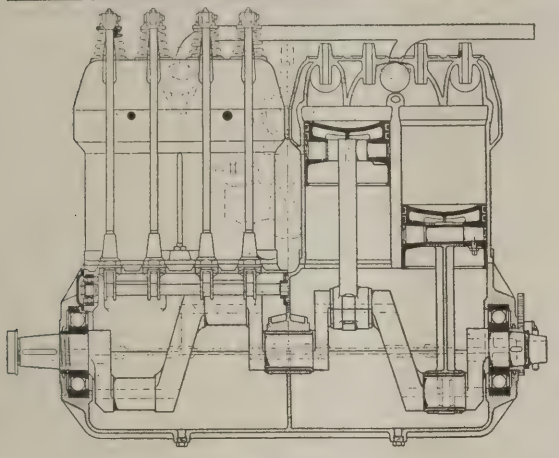


Fig. 13.

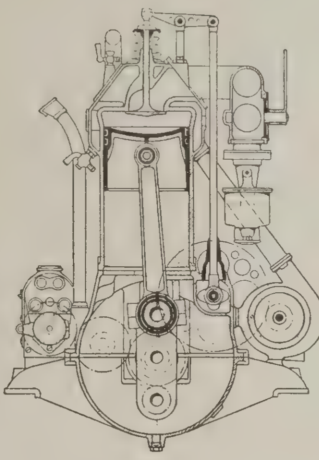


Fig. 14.

Figs. 13 and 14.—Four-cylinder Argus engine, 100 h.p., bore and stroke 140, speed 1,368 r.p.m., weight 348 lb.

Fig. 15.—Six-cylinder Mulag engine, 90-113 h.p., bore and stroke 110 × 170, speed 1,346 r.p.m., weight 482 lb.

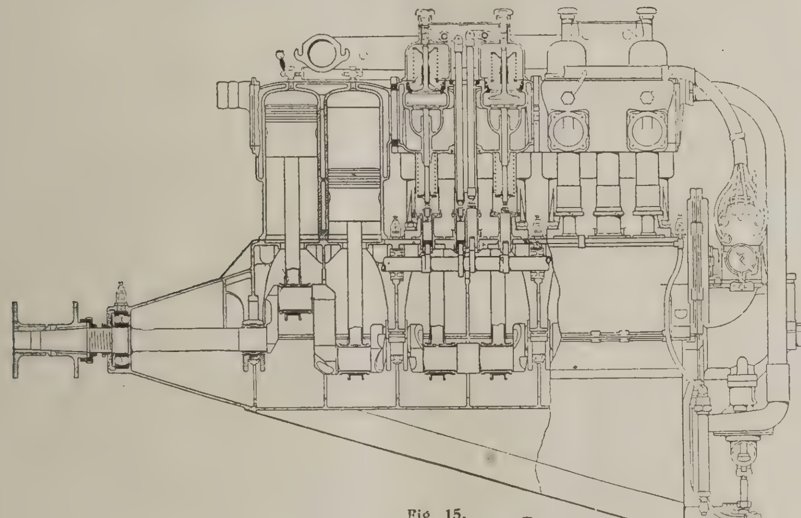


Fig. 15.

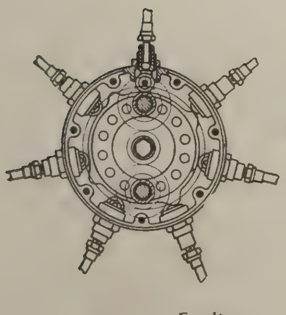
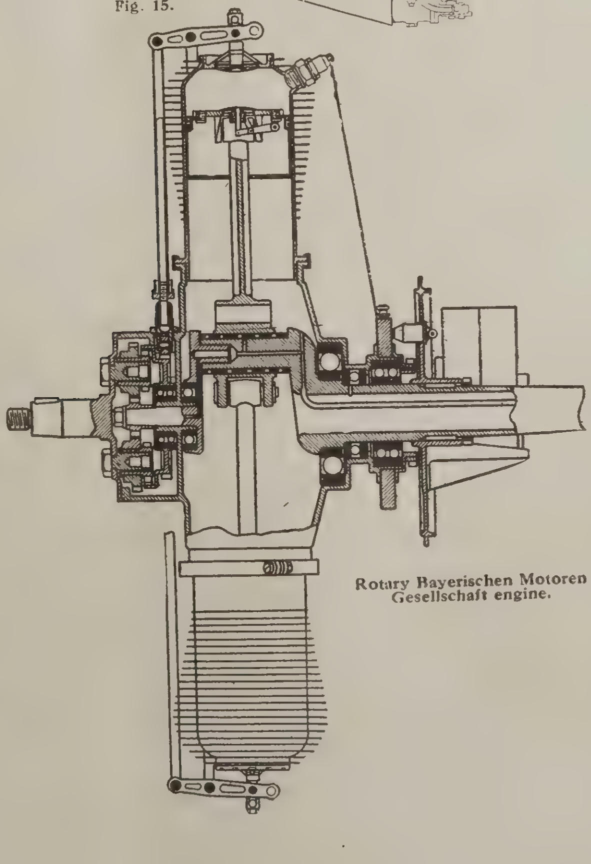


Fig 16



Rotary Bayerischen Motoren Gesellschaft engine.

stroke, there is a retardation effect which causes a second side thrust. This very large side pressure causes considerable rise of temperature, and for this reason the compression must be kept down, and therefore the horsepower per unit of capacity is low.

(To be concluded.)

Army and Navy News

The new Navy dirigibles ordered in February are nearing completion, it is learned, and in preparation for placing them into service the DN-1, a dirigible of the non-rigid type, is being used for training purposes at the Navy Aeronautic Station, Pensacola, Fla. About 250 officers and men are completing the first course at that station.

Sites for three of the nine training fields to be established by the War Department for the instruction of aviators, under the expansion of their arm of the Service, have been approved. They will be at Detroit, Mich., Dayton, Ohio, and Champaign, Ill. These fields are in addition to the "camps" to be located at Fort Leavenworth, Kans., Leon Springs, Tex., Monmouth Park, N. J., and near Monterey, Cal., for the training of the personnel of the new Signal Corps organizations of the Regular Army and of the Corps' reserves. To each of the last named "camps" will be sent one field battalion and one telegraph battalion of Regulars, to be used in training Service officers and enlisted men. About 200 Reserve officers are to be assigned to Monmouth Park, 100 to Fort Leavenworth and fifty each to Leon Springs and Monterey.

Under the provisions of paragraph 38, Regulations for the Enlisted Reserve Corps, Sergt. Harold L. Williamson, Aviation Section, Signal Enlisted Reserve Corps, Curtiss Aviation School, Newport News, Va., will be discharged by the Chief Signal Officer of the Army, by reason of his services being no longer required.

The following junior military aviators, S.C., from duty with the 1st Co., 2d Aero Squadron, S.C., and will take first available transport for the United States for further orders: Capts. Douglas B. Netherwood, Earl L. Canady and Leslie MacDill. (May 18, War D.)

The following aviation officers are assigned to and will join their respective organizations at Fort Sam Houston, Texas: Third Aero Squadron, S.C., Capt. Maxwell Kirby, U.S.A.; 4th Aero Squadron, S.C., Capts. B. M. Atkinson and G. E. A. Reinburg, U.S.A., and 1st Lieut. B. R. Osborne, Aviation Section, S.O.R.C.; 5th Aero Squadron, S.C., Capts. Carl Spatz and T. J. Hanley, U.S.A., and 1st Lieut. E. W. Bagnell, S.O.R.C. (May 5, S.D.)

Capt. James F. Byrom, junior military aviator, S.C., relieved detail in Aviation Section, May 21, 1917. Is assigned as first lieutenant to 21st Infantry, May 22, 1917; join regiment. (May 21, War D.)

The C.O., 3d Aero Squadron, S.C., will transfer 148 enlisted men from the 3d Aero Squadron, Signal Corps, to the 4th Aero Squadron, Signal Corps, and 148 enlisted men from the 3d Aero Squadron, Signal Corps, to the 5th Aero Squadron, Signal Corps. (May 5, S.D.)

Sergt. 1st Class James S. Krull, S.C., San Diego, Cal., will be discharged for the convenience of Government. (May 16, War D.)

A detachment of seventy-five enlisted men, S.C., to El Paso, Texas, for assignment to duty with Signal Corps organizations being formed. (May 9, Army S.S.)

A detachment of seventy-five enlisted men, S.C., to Fort Sam Houston, Texas, for assignment to duty with Signal Corps organizations being formed in that department. (May 9, Army S.S.)

A detachment of 400 enlisted men, S.C., under command of Capt. R. C. Hand, Inf., to Fort Sam Houston, Texas, for duty with aeronautical organizations at that post. Captain Mahlon Ashford, M.C., will accompany detachment. Upon completion of this duty Captain Hand and Captain Ashford will return to proper station. (May 7, Army S.S.)

I.—Sec. IV, G.O. 13, War D., 1917, is rescinded, and the following substituted therefor:

1. Organized units of the Aviation Section, S.C., employed in training or experimentation will be designated as school squadrons. Their initial organization and equipment will conform, as far as practicable, to that set forth in Tables of Organization, and the Tentative Manual of Equipment for Aero Units of the Aviation Section, S.C. (1916).

2. The following designations of school squadrons are announced:

First Aviation School Squadron, S.C. (present station near San Diego, Cal.).

Second Aviaition School Squadron, S.C. (present station near Mineola, N.Y.).

Third Aviation School Squadron, S.C. (present station near Memphis, Tenn.).

Fourth Aviation School Squadron, S.C. (present station near Chicago, Ill.).

Fifth Aviation School Squadron, S.C. (present station near Hampton, Va.).

First Balloon School Squadron, S.C. (present station near Omaha, Neb.).

FOREIGN NEWS

FRANCE

Paris, June 1.—Capt. Georges Guynemer, France, most famous air fighter, has now achieved unquestioned supremacy over all other airmen of any nation.

An official announcement issued to-day brings the news that he has raised his total of German machines destroyed in single combat to forty-three, greater than has ever been claimed for any other pilot, Allied or German.

(Capt. Boelke, Germany's most famous air fighter, was killed after he had, according to the German official bulletins, shot down thirty-eight Allied aviators. The German method of computation of "victories," however, is much more liberal than the French.

The German aviators claim as a victory every case in which the opposing machine is put out of action, whereas the French are not allowed to do so except in cases where the opposing machine was distinctly seen to fall by at least two observers besides the aviator who shot it down, and was distinctly seen to be destroyed by its fall.)

In achieving this total, moreover, Capt. Guynemer broke two more records, for he shot down four machines in a single day, two of them in a single engagement and within one minute of each other.

"In the period between May 17 and May 31," says the official bulletin, "thirty-two German machines were destroyed on our front during aerial combats, in addition to fifty-seven others which were seriously damaged and probably crashed to earth within the enemy lines. (These fifty-seven would have been claimed as destroyed according to the German method of figuring.)

"Capt. Guynemer brought down five machines, four of them on the same day. Two of these aeroplanes were felled in one minute, which is perhaps the first time in the war that such a thing has been accomplished. These five new victories bring up to forty-three the number of German machines destroyed thus far by this valiant officer.

"In the same period Lieut. Pinsard put out of action three German machines, triumphing over his fifteenth adversary. Other pilots who have increased the number of their exploits include Adjutant Madon, 12 machines; Sub-Lieut. Tarascon, 11; Adjutant Jaillier, 10; Capt. Matton, 6; Sergt. Souillier, 5."

GERMANY

A fine of $2,500 and three years imprisonment are the penalties imposed by the German authorities on Belgians who dare pick up proclamations or objects of any nature dropped by allied aviators in invaded territory. The inhabitants are forbidden to approach any flying machine that may be obliged to alight in Belgian territory and are obliged whenever an aviator lets fall any object whatever to notify the burgomaster, who in turn must report immediately to the kommandantur.

This measure is supposed in Belgium to be intended to put an end to propaganda by the aviators of the Belgian, French and British flying corps, who have until now succeeded in keeping the Belgians remaining in occupied territory more or less posted on the military situation.

A Berlin despatch, transmitted by the Exchange Telegraph Copenhagen correspondent, says that the Aeronautical Club will establish a Zeppelin route between Hamburg and Constantinople for both passengers and postal traffic at a cost of 40,000,000 marks. There will be eleven stations along the route.

GREAT BRITAIN

London, May 31.—At a meeting of the Aeronautical Society of Great Britain tonight a paper on "Commercial Aeronautics" was read by G. Holt Thomas, one of the pioneers of aviation in this country. Mr. Thomas said that in his opinion aeronautics would revolutionize the world not only from a commercial point, but also from a humanitarian point, much more than it had revolutionized war. He said he was not one of those who thought commercial aeronautics were going to beat out of existence the railroads and other forms of transport, but rather that flying would act as an adjunct to present modes of transport.

From a business point of view speed was everything. The aeroplane would enable a business man to leave London in the morning, go to business in Paris and be home again to dinner. It would take him to Bagdad in a day and a half or to New York in two days. Ceylon would become 2¾ days from London, Tokio 4½, Sydney 5, Cape Town 3½, and Vancouver 3.

As for the question of cost it would be possible to run a profitable air service between London and Paris at $25 a passenger, a cent an ounce for mails and 50 cents each for parcels of three pounds. A Constantinople or Moscow journey of twenty-four hours might involve a cost of $125 a ticket.

Mr. Thomas expressed the view that it would be necessary to establish landing grounds all over the world at distances of ten miles apart. Forced landings would thus be avoided as a pilot at a height of 3,500 feet or over could, if his engine stopped midway between two landing grounds, arrive at either of them. A long distance, as from London to Tokio, would really be made up of ten-mile stages, and the journey would be aerodrome flying, the pilot always having a flying ground on which to alight.

Fog would certainly be overcome, as some form of mark would be easily developed. The question of night flying would also be solved, since with a searchlight every ten miles a pilot could fly. Once this principle was accepted, even the crossing of the Atlantic would become feasible. What was there to prevent the keeping of a ship, not necessarily anchored, but always cruising, say every fifty miles from the Azores to Newfoundland? Compared with the enormous scheme that an air mail between London and New York would present, the cost of ten or twenty ships was infinitesimal.

London, June 1.—Lieut. William Leefe Robinson of the Royal Flying Corps, who is a prisoner in Germany, recently was transferred to Freiburg as a reprisal for air raids against that city by Entente aviators, according to the Central News.

"On Wednesday night," says an official bulletin tonight, "many long-distance bombing raids were carried out by our aeroplanes with good results against hostile ammunition depots and railway stations. In the air fighting yesterday two German aeroplanes were brought down and one other hostile machine was driven down out of control. None of our machines is missing."

Lieut. Robinson was awarded the Victoria Cross for bringing down a Zeppelin during a raid on London. He was captured by the Germans last April. A despatch from Berlin on May 12 said that British and French Army officers held prisoners had been sent to Freiburg as a reprisal.

With the British Armies in France, June 2.—British pilots continue to bring in accounts of how German aeroplanes break to pieces in the air soon after being attacked.

This tendency has been notable for more than a fortnight. Once shot out of control, the German planes have lost their wings, tails and other gear to such an extent that when they finally crash to the ground very little wreckage can be seen.

A day or two ago a British pilot flew at an enemy machine head-on, manœuvring at the last moment just in time to avoid a collision. One of the wings of the British plane, however, scraped one of the German's wings, whereupon the latter began to fall. The British pilot dived after him and was startled to see the German's damaged wings fly completely off while the tail dragged as if its back were broken.

London, June 2.—The morning papers figure that 713 aeroplanes were shot down on the western front in May, of which 442 were German and 271 British and French. British headquarters admitted the loss of 86 machines, but as the French do not announce any war losses it is impossible to verify the inference that they lost 185.

The estimate of 271 is compiled from German official reports. The total air losses for April were estimated at 709.

London, June 3.—News has been received from British Headquarters in France through the War Office by his parents in Nottingham that Captain Albert Ball, D. S. O., the famous aviator who was missing about a month ago after an air engagement, is now officially reported killed. He is buried at a place named Annoeullin.

Captain Ball won international reputation as an accomplished airman, having brought down over forty enemy machines. He won the D. S. O. with two bars and the military cross and had received honors from the Russian and French Governments. Shortly before returning to France he received the honorary freedom of Nottingham.

Up till quite recently strong hopes were entertained that, although reported missing, he was a prisoner of war in Germany. Captain Ball was only 21 years of age, was absolutely fearless, but never a reckless flyer. General Trenchard of the Royal Flying Corps described him as the most daring, skillful, and successful pilot the Royal Flying Corps ever had. When he came home in October last on leave, prior to taking up six weeks' duty in this country as an instructor, he had thirty German aeroplanes to his credit. In a fortnight after his return to the front last month he had raised his bag to forty-two.

It was characteristic of him that on his arrival after flying across the Channel he passed right over the British lines and attacked enemy airmen, bringing down two in a fight at 15,000 feet, and then calmly descended to report at headquarters that he had returned to duty. In his last fight he was set upon by six of the enemy's best fighting machines. He brought down one and damaged two others seriously, but others appeared on the scene and he was cut off from his comrades of the squadron and was ultimately forced down.

SWEDEN

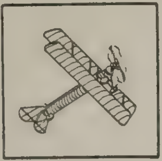
Copenhagen (via London), June 2.—A Zeppelin appeared over Swedish territory on Friday morning near Malmo and was driven away by the fire of Swedish torpedo boats.

The airship also approached the Danish frontier south of Copenhagen. Troops guarding the coast fired a number of warning volleys, after which the Zeppelin disappeared in a southerly direction.

Stockholm, June 1 (via London, June 2).—Public opinion here grows more irritated over the continued and increasing loss of Swedish ships, particularly in the Baltic. This smouldering anger is displayed despite the Swedes' racial predilection for Germans.

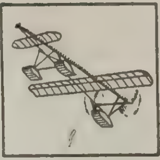
The Swedes received a shock yesterday from a new demonstration of German "tactlessness" toward a neutral. Two German hydroplanes flying over Swedish territorial waters near Landskrona attacked a celebrated Swedish aviator, Dr. Thulin. In their flight the Germans surprised and attacked Dr. Thulin, who had mistaken them for Swedish flyers. When he discovered his error he beat a hasty retreat to the shore. His aeroplane was not armed.

Swedes who witnessed the skirmish confirmed the statement that the German hydroplanes were over Swedish territorial waters. The incident has made a painful impression in political circles and on the thinking part of the public, particularly as it comes just after the most unsatisfactory semi-official German justification for sinking Swedish ships.



MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City
PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
LONG ISLAND MODEL AERO CLUB
401 Grant Ave., Cypress Hills, L. I.
BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn
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924 Wabash Ave., Youngstown, Ohio
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BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Aero Science Club Activities

With the beginning of the new fiscal year of this organization, a new policy in connection with the holding of meetings has been outlined and in the future will be adhered to. At a meeting of the club held on the 26th of May, 1917, it was decided that the first Saturday in each month be utilized for a business meeting, the second Saturday for a lecture meeting or for the purpose of holding discussions on the different phases of aeronautics in general, the third Saturday for social activities, and the following Saturday or Saturdays which may occur in the month will be utilized for the holding of lectures or aeronautical discussions. It is believed that the plan above outlined, which is a radical departure from our former methods will intend to increase good fellowship among our members, will educate new members in the science of aeronautics and will generally increase the membership of the club.

It is needless for us to state that as usual, we desire to invite to our meetings, all of our members, their friends and any persons who may be in any manner at all interested in the science of aeronautics.

At the yearly meeting of the club, held some time ago, the former officers, whose services in conjunction with the club were so efficient in the past were re-elected. For the information of those who are not acquainted with the officers of the club we would state that their names and the offices held by them are as follows:

Harry G. Schultz, President; George Bauer, Vice-President; Arthur N. Ott, Secretary; Ladis Gladki, Treasurer.

A great many of the members are now connected with the various aeroplane construction companies throughout the country in the active construction of machines. Mr. E. P. Lott of Newark, N. J., has been for some time connected with the Aeromarine Company at their flying grounds at Keyport, N. J., and has made several flights with Clarence DeGiers, the company's aviator in the new Aeromarine hydro.

Mr. Charles W. Meyers has been located at the Keyport grounds of the Aeromarine Company, from thence has been situated at Mineola and of late has resumed his activities at the Nutley, N. J., shops of the company. Mr. R. C. King is also engaged at the Aeromarine Company's plant at Nutley.

Messrs. Graulich, Schober and Surini are now located at Green Bay, Wis., in the employ of the Lawson Aeroplane Company at that place. In accepting a position with the above mentioned company, Mr. Graulich has been forced to relinquish activities on his miniature automobile which he constructed. Those who have seen Mr. Graulich's machine have stated that it is a perfect representation of a small racing car and its workmanship is excellent.

As usual, meetings are held every Saturday evening at the club rooms, 29 West 39th Street, New York City.

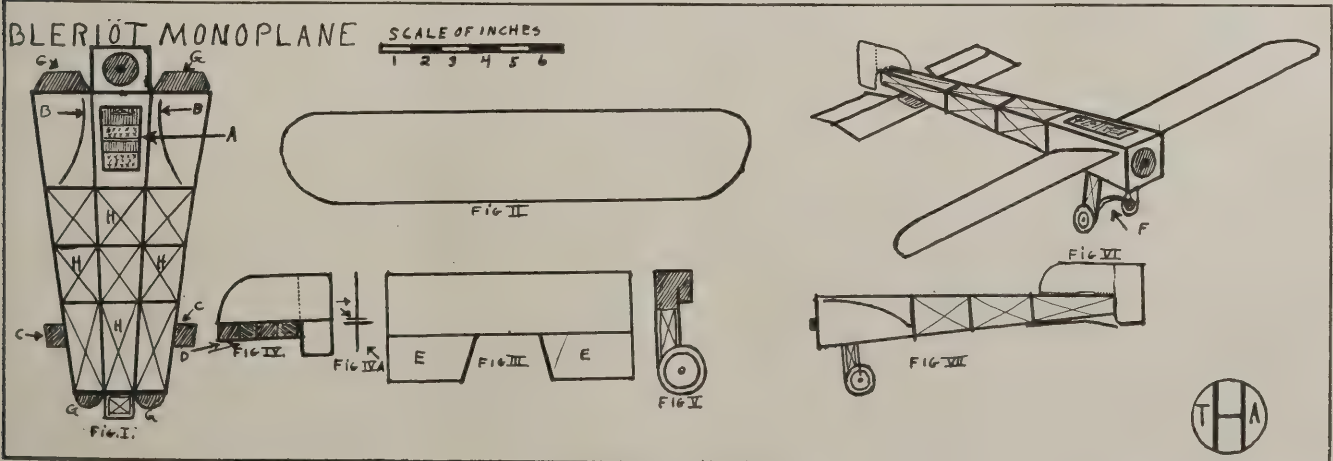
Paper Model of Bleriot Monoplane

By Theodore Hodgdon

It does not seem as though the present high cost of paper is in any way interfering with the experiments of the paper model enthusiasts as is indicated by the constant flow of descriptions which are coming in concerning paper models. Another advocate of the paper model is Theodore Hodgdon of Sangus, Massachusetts who affords us the opportunity and pleasure of reproducing a drawing and description of a paper model Bleriot Monoplane.

After the diagram for the fusilage, planes, rudder and landing gear are ready all should be cut as indicated. Then the ends and sides of the Fusilage (Fig 1) should be bent as outlined. The flaps (G G) are next pasted to the ends thus forming a complete fusilage into the sides of which, slots (BB) should be cut for the reception of the plane (Fig 2) which is inserted therein. The tail plane (Fig 2) is next to be considered and this should be made as indicated by the shaded flaps (CC) and then pasted to the bottom of the fusilage, the rudder (Fig 4) is next to be cut. The flaps (DDDD) should work independently one being twisted to the right and one to the left and so on so that there will be two flaps on each side (Fig. 4a). To insure lateral stability for gliding the rudder is made much larger than is usual. The landing gear is cut in accordance with Fig. 5, the shaded portion being pasted onto the inside of the fusilage and a brace added for strength (F), (Fig. 6).

To add to the appearance of the model the cockpit (A) as well as the framework of the fusilage (H) is drawn on the model. When gliding the model a small weight is placed at the center of the front of the fusilage and the elevators adjusted until the machine glides satisfactorily. After several attempts many pretty glides may be made.



Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Preparing for the Tests

Although we know that it will cause our readers very deep pain, we feel that, in justice to those kind people who have struggled through page after page of our stuff, we must make an announcement. Prepare for the worst (or should we say best)—on the 15th of June we take our examination for a commission as a First Lieutenant in the Aviation Section of the Signal Corps. We have stood at recruiting stations, watching eloquent orators plead for recruits, but yet were not moved until one day we saw an old pal go by in the uniform of a Lieutenant, and that settled us. If *he* could do it, there was no reason on earth why *we* couldn't.

So picking up a copy of an esteemed Sunday newspaper, we glanced over the things which an aviator is expected to be able to do. We read along. "He must be able to balance on one leg with his eyes closed." Why, that sounds easy! We arrived home one night, and decided that we had better practise standing on one leg with our eyes closed—both of them, *tight*.

Taking a good look around to make sure of our bearings, we very slowly closed both eyes, and lifting one leg from the floor started in to balance. We say *started* to balance, because we ended by putting one foot very gently through the door of the china closet. However, we did not give up, and now after a few hours' practise we can truly say that we can equal the best stork that ever stood on one leg, deciding whether it should be a boy or a girl.

Then we practised hopping backward, frontward, and sideways with our eyes closed. That was easier than the other because we took our shoes off and hopped along a seam in the carpet. Our hope now is that at the examination they will have a carpet on the floor with a big seam in it.

The hardest thing of all was trying to hear a watch tick at forty inches away, with the people next door holding a patriotic revival. We listened about ten minutes, and then decided that it would do us no good anyway, because we were listening to a Waterbury, while the examining officers will probably have a watch that is not quite so loud.

We then glanced at the table of heights and weights. We found that we are just about thirty pounds heavier than is allowed by the Government. So the first day we tried to go without lunch. We did *not* succeed. About three o'clock in the afternoon we became so hungry that we were actually dizzy, and went out and broke the go-as-you-please eating record. And now, in conclusion we will state that we have not much hope of passing the examinations unless a miracle happens. We are going to take the examinations, and if they want us, well and good. If they don't, well, and better.

Ave! Morituri Salutamus!

The Alms of the Law in Canada

There was a time in Canada when a man engaged in aeronautical work was singularly immune from the law. In fact it is related that Tony Janus, in the Spring of 1915, used a Henry Special (Ford), to travel between Toronto and the Aerodrome of the "Canadian Aeroplanes, Limited." As Tony was always in a hurry he made the Ford travel its limit until one day he was reported for speeding. At one hearing he had *seven reports,* but the Judge, on hearing that Mr. Janus was engaged in teaching aviation, and building aeroplanes for the Allies, said: "We must be lenient to these fellows as they are here to help us win the war." He dismissed the case. It seems that now the Canadian judges must have become confident of winning the war, as they refuse to forgive speeders any more.

The Chief Pilot of the Canadian Aeroplanes, Limited, Mr. Harry J. Webster, made a trip from Toronto to Buffalo the other day, and on the way through Burlington, Ont., was reported for speeding, and summoned to answer the charge. Mr. Webster inquired if he pleaded guilty, would he need to appear for hearing, and in answer to his letter received the following, absorbingly interesting, from the Police Magistrate:

Burlington, Ont., May 7th.

H. J. W.
Dear Sir:—

Yours of the 4th before me. When you plead guilty you can settle without coming. My paper says you was speeding at 35 miles per hour. If it is the first offence the fine will be—Fine, $10.00; cost, $3.05 equals $13.05. If it is a second offence it will be $5 more. Please send an Express order

And Oblije

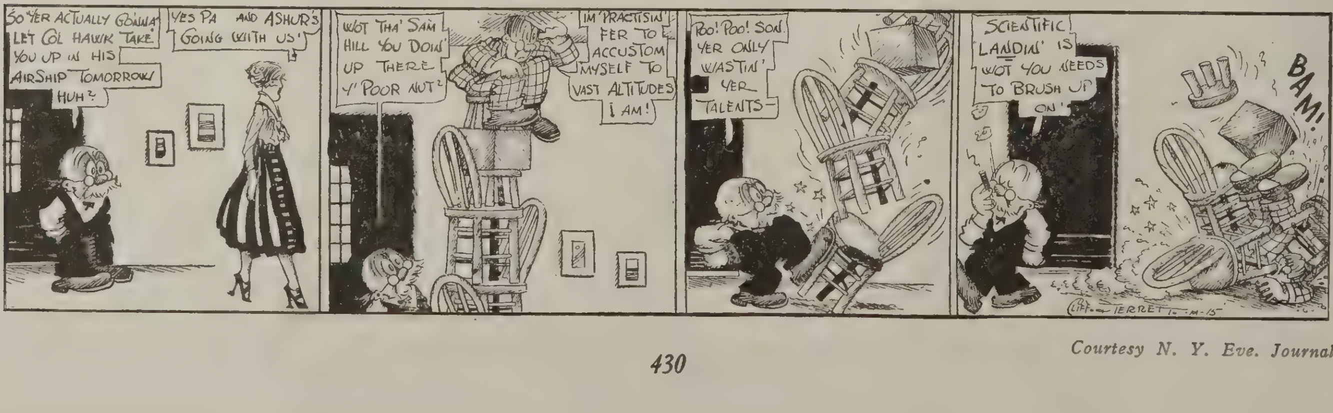
W. J. Barr, P.M.

(P.M. means Police Magistrate, not Post Meridian.)

Thorough Preparation

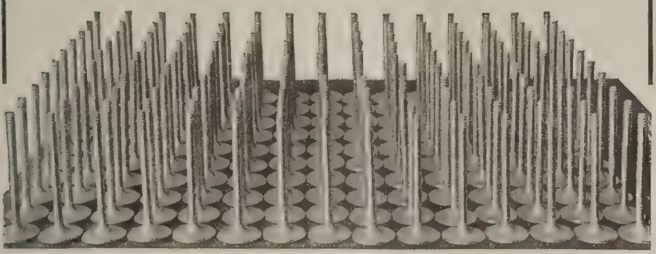
Under the title "$75,000 Needed for Westport Aviation Base," a Connecticut newspaper includes the following sum in the estimate of money needed to equip the station completely: "8,000 for a speed boat for the purpose of picking up aviators who fall in the water—a very necessary part of the equipment of a training camp!"

We hope they get the money. Any one so far-seeing deserves to have his preparation rewarded. Still it seems to us that they might have gone further and included a sum for the purchase of court-plaster and liniment. Also a sum to pay a tailor for pressing the aviator's clothes after he is picked up from the water.


SO YER ACTUALLY GOIN' TA LET COL HAWK TAKE YOU UP IN HIS AIRSHIP TOMORROW HUH?
YES PA AND ASHUR'S GOING WITH US'
WOT THA' SAM HILL YOU DOIN' UP THERE Y' POOR NUT?
IM PRACTISIN' FER TO ACCUSTOM MYSELF TO VAST ALTITUDES I AM!
POO! POO! SON. YER ONLY WASTIN' YER TALENTS—
SCIENTIFIC LANDIN' IS WOT YOU NEEDS TO BRUSH UP ON'
BAM!

Courtesy N. Y. Eve. Journal.

MOBILIZED



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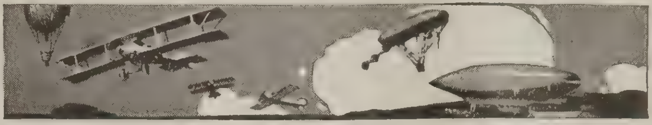

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As such they are impressive, but they are not vital.

Were they to disappear today, Goodyear construction would still go on tomorrow.

For the manifold production, the technical ability, the hard-won experience essential to successful dirigible construction would remain.

And by the day long since specified the Goodyear dirigibles now being built would take their clattering flight over the Goodyear testing ground.

They are not, and could not be, the product of a few great rooms and some frantic months of labor, but are the creation of many factories and groups whose experience and skill the Goodyear department of aeronautics has commanded to its service through six pioneering years.

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THE authorities have agreed that the greatest possibility of getting decisive victories is to strike Germany from the air. To do this will require thousands of aviators, and tens of thousands of aeroplanes. How this will be done is told in

***Flying* for June**

How the navies of the world use Aircraft Motherships is discussed in a ten page, profusely illustrated article by Henry Woodhouse.

Admiral La Caze, the French Minister of Marine, reported to the Chamber of Deputies recently that France has 552 coast patrol units, with seaplane stations all along the coast, so that the zone of action of each joins that of its neighbor. Admiral La Caze's statement, illustrated by the types of seaplanes used in this work, appears in Flying for June.

Amongst other important subjects dealt with in this issue are: Plans and Personnel of the Aircraft Production Board; Balloon Training; Hunting Submarines from the Air; Rules and Regulations Governing Aerial Reserve Corps; and News of the Aerial Coast Patrol Units.

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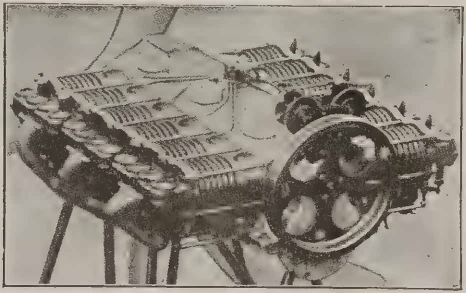

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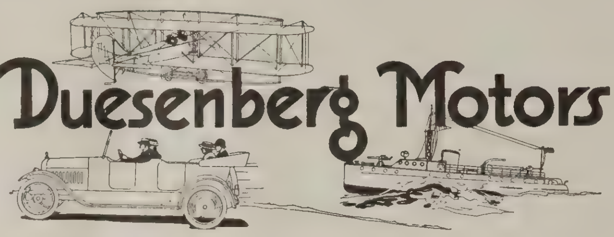

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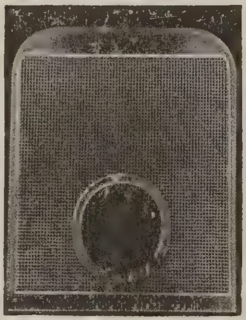

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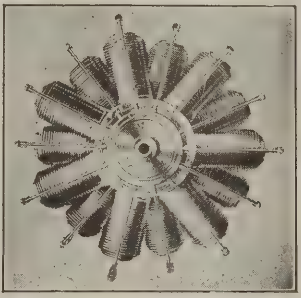

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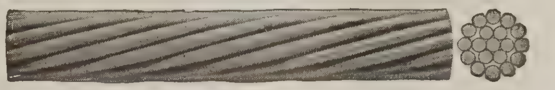

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NEW AND USED AIRPLANE MOTORS. 14-35 and 55 horsepower rebuilt motors guaranteed. Immediate delivery. Prices right. Also "Air-drive" Motors for shallow draft boating. Kemp Machine Works, Muncie, Indiana.

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WILSON CABINET COMPANY
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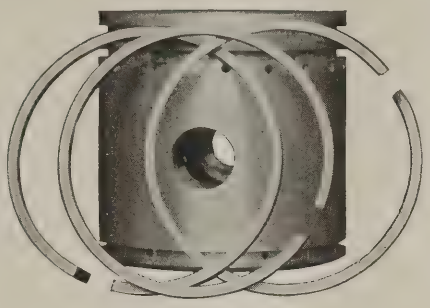

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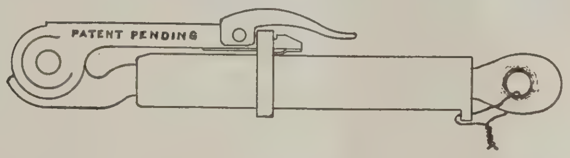

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The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

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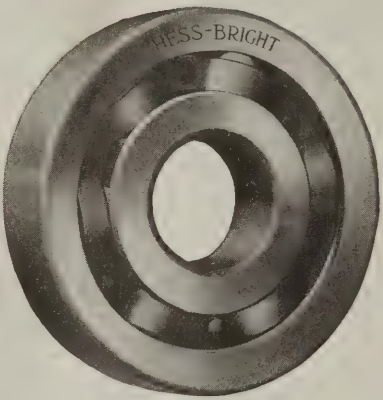

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A Lewis used as an anti-aircraft gun masked in wheat field
Official photograph (Crown copyright) taken on the front in France

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"In the last engagement I saw in the recent Somme offensive, whole detachments were going into the trenches with every man carrying a Lewis Gun as one would carry an ordinary rifle."

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JUN 19 1917

AERIAL AGE
WEEKLY

Vol. 5, No. 14 JUNE 18, 1917 10 CENTS A COPY

A Military Aeroplane Directing the Movements of Troops in a Maneuvre at a Recent Garden Fete at Governor's Island

$1,000,000,000 for Huge Air Fleet of 100,000 Aeroplanes

The World's Latest Battleplanes

Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities

THE CURTISS AEROPLANE CO., Buffalo, N. Y.

AN EDUCATIONAL PRESENTATION

Of Aero Construction By The

STANDARD AERO CORPORATION

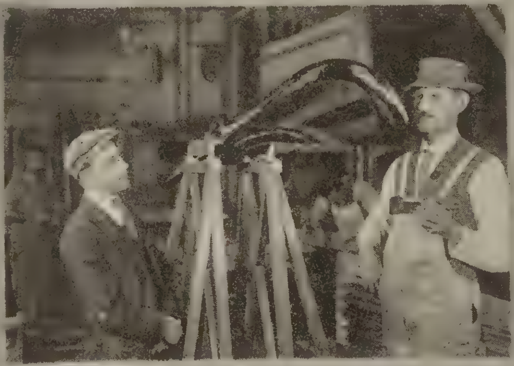
THE illustrations for this magazine are from the motion picture film taken at our factory. The picture took four days to complete, and included views of the manufacture of the minutest metal parts, their inspection, and their installation, through to the erection of the complete machine, packing, unpacking, setting-up and flying.

The film was produced under the auspices of the War Department, to be used in schooling Government aviators in the methods and processes of manufacture. The illustrations given here are taken from the available still pictures and give but a slight indication of the extent or the detail of the film.

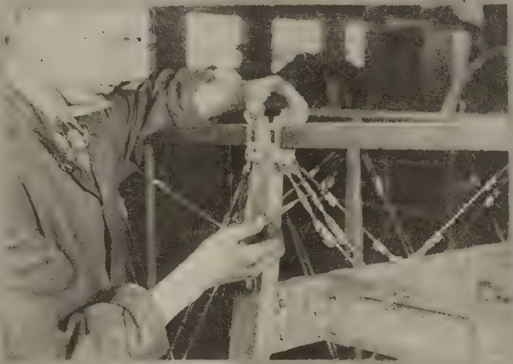
AN EDUCATIONAL PRESENTATION BY THE

STANDARD AERO CORPORATION

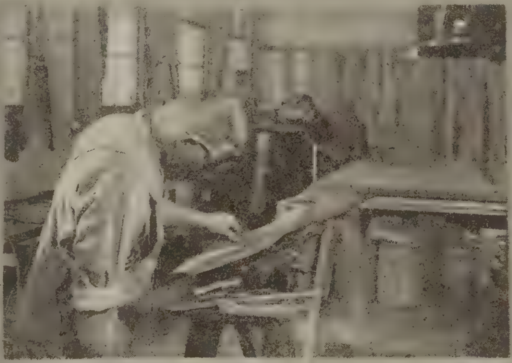
SHOWING A FEW OF THE STEPS IN THE MANUFACTURE OF AIRPLANES



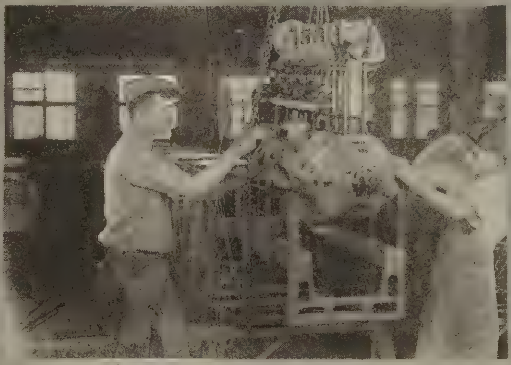
Finishing touches to the propeller bring it to perfect balance.



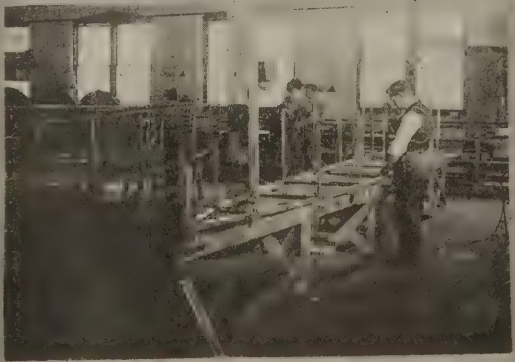
Every wire at each station in the fuselage is tuned to the proper degree of tautness.



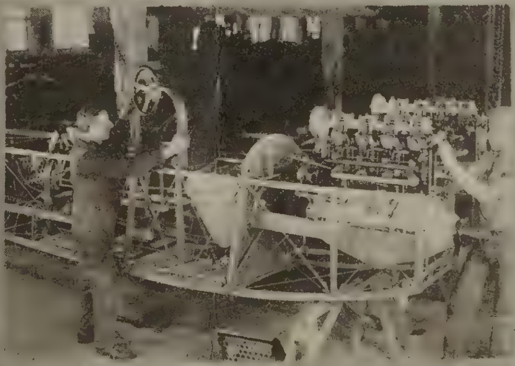
The propeller being gauged during the process of planing.



Not until the fuselage is absolutely aligned is the motor put in its place.

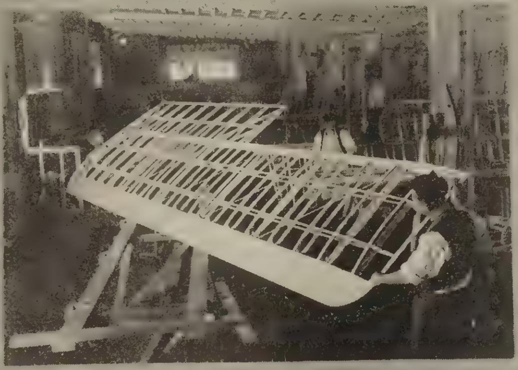


The lower longerons are laid out on the fuselage bed & the struts carefully located.



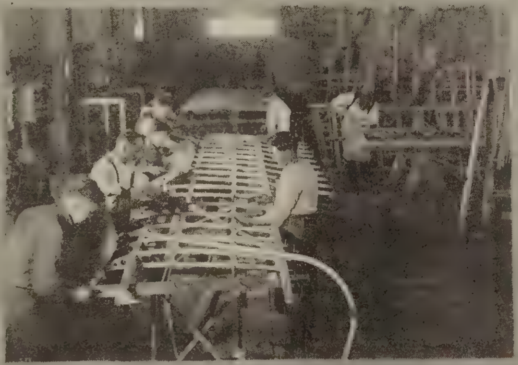
Tanks, instruments and controls are quickly placed, once the fuselage is aligned.

AN EDUCATIONAL PRESENTATION BY THE
STANDARD AERO CORPORATION
SHOWING A FEW OF THE STEPS IN THE MANUFACTURE OF AIRPLANES

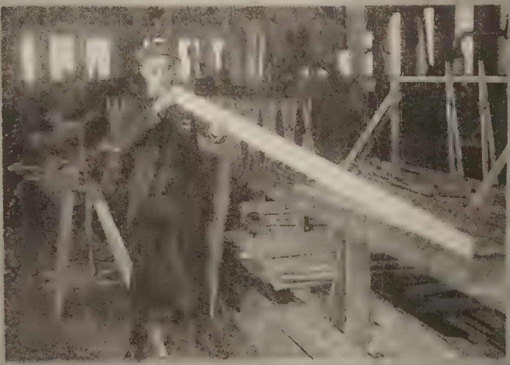


The completed wing - a splendid, graceful structure. Note wiring through rib construction giving rigid bracing.

Frequently gauging the struts assures a perfect streamline form.



Ribs are assembled with the greatest accuracy & each part shaped to conform to the proper curve.



The trained eye readily detects the slighest flaw in the construction of the wing strut.

Last stage of wing manufacture. Note the partly covered wing in the rack at right.

Every spoke in the landing wheel is adjusted to stand the strains for which it is built.

SINCE its inception, the Standard Aero Corporation has had remarkable growth; rapid, yet firm and well grounded. There has been gathered together and developed a personnel that challenges every organization in the country; an organized staff of executives, heads of departments, foremen, that honors the institution. Mr. Charles H. Day, Chief Engineer and Designer, is a foremost figure in aeronautic circles.

Throughout the organization there is a splendid spirit of cooperation and loyalty. "The Standard Aero Club," made up of employees, maintains its own club rooms, library of magazines and books, its own orchestra, and its baseball team. Regular weekly meetings are held at which scientific and practical papers are taken up and discussed. The Club typifies the spirit of the organization.

OVER all the processes involved in the manufacture of Standard Airplanes the workmen toil with the care and diligence of the sensitive craftsman; no pains or efforts are spared to make our planes absolutely dependable. Of the planes designed and built by us, the following are current models:

(1) Model J—Primary Training Machine.
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(3) Model H-3—Military Reconnaissance.
(4) Model H4H—Advance Hydro Training Machine.
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TEXTBOOK OF NAVAL AERONAUTICS

WITH A FOREWORD BY REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

By HENRY WOODHOUSE

Member Board of Governors, Aero Club of America
Member National Aerial Coast Patrol Commission, etc., etc.

AN AUTHORITATIVE BOOK OF ABSORBING INTEREST

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Training of Aviators.
Course of Instruction and Required Qualifications of Personnel for the Air Service of the United States Navy.
Course of Instruction for the Training of Aviators by Lawrence B. Sperry.
Aerial Navigation Over Water by Elmer A. Sperry.
Aeroplane Guns and Aerial Gunnery.
Night Flying.
Regulations Relating to Enrollments in the United States Naval Reserve Flying Corps.
Types of American Seaplanes.
Naval Dirigibles.
Aeronautic Nomenclature.

For all who wish to fly in the service of the Navy, or for pleasure, this work is indispensable. The general reader will find this record of the conquest of the air in the Great War as entertaining as the most thrilling fiction.

The official records of the amazing activities of the embattled air fleets are described and illustrated in detail. A comprehensive library on aeronautics is comprised in this single volume. Special chapters have been contributed by the leading authorities on aeronautics in America, including Rear Admiral Bradley A. Fiske, Rear Admiral Robert E. Peary, Elmer A. Sperry, Lawrence B. Sperry, and others.

The invaluable assistance of aircraft both in offensive and defensive operations, their revolutionary effect on the science of naval strategy, their value in supplementing the work of the fleets and in guarding our coastline from attack, are described in the light of their actual achievements in the Great War. The organization of the several aeronautic services in connection with the United States Navy is given in detail. The book presents in convenient form the latest official information concerning the aerial defenses of the fifteen Naval Districts, the administration of our naval aeronautic stations, the course of instruction required for the air service of the United States Navy, and a wealth of similar material.

In an appreciative foreword, Rear Admiral Bradley A. Fiske describes the book as "clear, correct, and stimulating."

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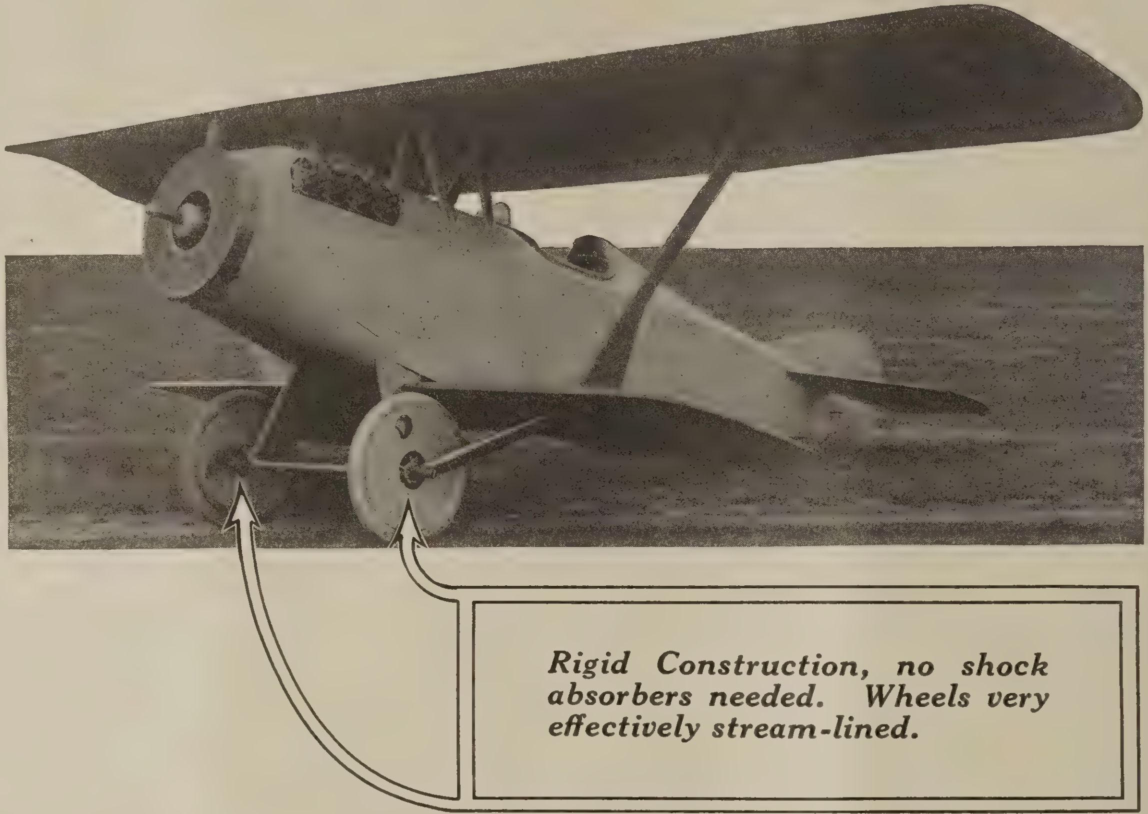

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AERIAL AGE
WEEKLY

HENRY WOODHOUSE
Contributing Editor
NEIL MacCOULL, M. E.
WALTER H. PHIPPS
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THE TRADE AUTHORITY

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Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879
Subscription Price, $4.00 a year, Foreign, $5.00. Telephone, Murray Hill 7489

VOL. V NEW YORK, JUNE 18, 1917 No. 14

LEADING NEWSPAPERS ASK FOR $1,000,000,000 FOR HUGE AIR FLEET OF 100,000 AEROPLANES

THE country's leading newspapers—including the New York *American, Herald, Sun* and *Times;* and other important papers throughout the country—are asking for $1,000,000,000 for building a huge air fleet of 100,000 aeroplanes with which to strike Germany through the air.

In a full page editorial, illustrated with a striking drawing by Winsor McCay, the *American* says in part:

"Fifty thousand American aviators in fifty thousand flying machines, each dropping one hundred dynamite bombs on German soil, will do the work.

"There is no use camping and killing millions of men in trenches, when the air above the trenches is free, THE GERMAN FRONTIER OPEN. One American in his flying machine, with his supply of dynamite, would do the work of ten thousand men in the trenches.

"The thing that Germany needs to bring home the peace idea is to see the enemy in the air above, and feel some war on home soil. This will bring peace at the least possible expense of human life, and that is what Germany and all the rest of the world must want."

In a four-column editorial signed by Frank A. Munsey, the New York *Sun,* the Washington *Times* and other newspapers ask for immediate action on a plan to supply 100,000 American aeroplanes for the Western front. This forceful editorial says in part:

"With 100,000 machines to their own output, the Allies can destroy the Enemy Air Squadron, and without aeroplanes Germany would be without military eyes. America has the genius and the money to meet this call, and should meet it."

The New York *Times* in a long editorial entitled "First of All Aeroplanes," discusses the subject from different aspects, demands an immediate appropriation of $1,000,000,000 to carry out the program. This editorial also says, in part:

"Secretary Baker and Brig.-Gen. Squier, Chief of the Signal Corps, are planning the creation and equipment of a great American aeroplane force. By no other means can we so quickly and so surely render valuable aid to our allies. Development of this force, in fact, has been under way for some time, but on too small a scale. The Government has been striving to atone for our neglect of an invention which has proved to be of prime importance in modern warfare, but the appropriations for military air service have been entirely too small. To render effective service we must train 10,000 aviators and build not fewer than 40,000 aeroplanes. The experts of the Aero Club of this city calculate that one aeroplane is needed to train one aviator. This is a fair average, as the flying machines in active use are short lived. Three planes are needed to equip each trained airman. It is the idea of the Aero Club that at first we should concentrate our energies on the building of training machines. The Signal Corps, with the aid of the Council of Defense, has located and listed all the manufactories in this country in which aeroplanes can be built. These include the automobile factories and many of the larger furniture factories. The building of training machines will expedite at home the education of airmen, while those that we can quickly send abroad will release hundreds of British and French machines for actual war service.

"Aeroplanes can be rapidly built. We have the aviation fields and the hangars. We have the men. Money is all that is lacking and the people of this country expect the vast sums to be raised by bond sales and heavy taxaxtion to be expended to the best advantage for the earliest possible conclusion of the war. We ought to be doing good service to the cause of world democracy on the western front in France and Belgium before next winter."

THANKS to the close co-operation between the military and civilian authorities, the Aircraft Production Board, the National Advisory Committee for Aeronautics, The Aero Club of America, the Aircraft Manufacturers' Association, and the Society of Automotive Engineers, substantial progress is being made in developing the plans for a large aerial program.

Uninformed people are trying to create the impression that there is not the closest co-operation between the official and civilian organizations interested in aeronautics, and to make it appear that the Aircraft Production Board and the National Advisory Committee for Aeronautics are not unanimous in fathering a plan for getting a practically unlimited number of aviators and aeroplanes in the shortest possible time.

Those acquainted with the conditions know that there is positively no confusion or divergent opinions on this point and that delay can only occur through Congress failing to allow the funds necessary for carrying out an extensive program to provide ten thousand aviators and fifty thousand aeroplanes in the shortest time possible.

The National Advisory Committee for Aeronautics was authorized by Act of Congress approved March 3, 1915. The members were appointed by the President, and include representatives of the War and Navy Departments, also the Departments of the Treasury, Agriculture, and Commerce, and the Smithsonian Institution; in other words, all of the departments interested in questions coming before the Committee, with the exception of the Post Office Department, which is interested in the acquiring of the best machines for aerial mail service. Four technical members were appointed from without the Government service.

The Advisory Committee, under appropriation by Congress, began its work at once, with a view to first, organizing the aeronautic industry into an association; second, clearing up the patent situation in relation to aeronautics, and third, getting the industry into line to provide for quantity production of aircraft.

All of these results were brought about and on March 29, 1917, a communication was addressed to the Secretary of War and the Secretary of the Navy, and a copy transmitted to the Council of National Defense, recommending a continuing program for the production of aircraft.

On April 10, 1917, the Advisory Committee recommended to the Council of National Defense that an Aircraft Production Board be appointed to take over the consideration of the various questions arising in connection with the production of aircraft and the training of aviators, both for governmental and civil purposes.

Both of the above recommendations were approved and an Aircraft Production Board was appointed, with Mr. Howard E. Coffin as chairman.

CONGRESS again holds the key to the situation. To carry out a real war air program there is needed the best part of $500,000,000. In bringing Congress to realize this fact, the Aero Club of America has proven to be a most efficient factor. The Club represents the general public in aeronautics and its advice is always listened to in Congress and its opinions have always been found to be supported by the press of the country. Last week, when it became known that Congress in the stress of events might overlook the necessity of providing an extensive air program, the Aero Club of America took steps to bring the matter to the attention of Congressional leaders. On June 7th Mr. Alan R. Hawley, President of the Club, wrote to Senator Chamberlain as follows:

"We are receiving many inquiries from patriotic newspapers, organizations and individuals who are inquiring as to what there is being done by the Government towards carrying out a plan to train and equip a sufficient number of aviators to send to France to assist the Allies in getting and maintaining supremacy in the air and 'striking Germany through the air.'

"There is a general realization of the fact that nothing short of a plan that will train and equip 10,000 aviators within not more than 18 months or two years—which is the time that was required by the Allies themselves to get a similar number of aviators—will be an adequate plan. Therefore, the query resolves itself as to whether the Government is taking steps to carry out such a plan.

"Such a plan cannot, of course, be carried out unless Congress allows the funds necessary for the training of the 10,000 aviators and the building of the 40,000 aeroplanes needed to train and equip the aviators. As you know, an aviator must have about 40 hours in the air before he is 'considered to be qualified for military service. Some of this training must be done with slow machines, some with faster machines, and some with machines flying at a speed of up to 120 miles an hour. On the average, it takes an aeroplane to train each aviator. Then it takes three aeroplanes to equip each aviator. This makes a total of 40,000 aeroplanes which are needed to train and equip the 10,000 aviators.

"To carry out such a plan will take about $500,000,000. This sum may seem and is large, but it really seems to be the most economic way of solving the problem of striking Germany.

"Great Britain is spending $575,000,000 this year for aeronautics. She spent $375,000,000 last year. The report of the British Comptroller of Aeronautic Supplies states that there are 958 firms engaged on work for the British Directorate of Aeronautic Supplies, 301 of which are direct contractors and 657 are sub-contractors. This report states that the total number of hands employed by the fifty firms of most prominence is 66,700. Great Britain is at present getting 4,000 aeroplanes a month, but this is far from being sufficient, as there are hundreds of aeroplanes used daily in air flights and for bomb dropping expeditions and other purposes.

"The above figures not only emphasize the necessity of establishing sources of supplies of aircraft in the United States, but also the necessity of taking steps immediately to produce aircraft in large quantities, so as to relieve if possible the thousands of mechanics who are working in the aircraft factories, to send them to the front as mechanics for additional aero squadrons.

"Germany's U-boat warfare and the necessity of keeping the German fleet bottled up are occupying the navies of the Allies and no decisive victory over the Germans is expected in naval actions in the near future. Likewise, advances against the Germans on land are slow, and Germany has seemed able so far to always throw new thousands of men and new lines of trenches and countless guns to meet the advance of the Allies. The only victories on the part of the Allies so far have been as a result of supremacy of the air, as a result of the matching of skillful, daring allied aviators against German aviators and observation balloons; the recent British and Italian victories were preceded by countless aerial fights in which hundreds of aviators took part, and it was not until the skies had been cleared of German aviators and of German observation balloons—and the Germans were thereby deprived of the aerial eyes of the infantry, of the aerial scouts, and the Allies' aviators, being masters of the air, could follow the movements of the enemy and locate their batteries and their strongholds—that the victories became possible.

"If by carrying out this plan speedily we can shorten the war by even only a few weeks, there will be saved thousands of lives and billions of dollars. Therefore, no time should be lost in carrying this plan into effect.

"There is no question that, provided the appropriations are made immediately, this number of machines can be built in this country within 18 months.

"Please advise at your earliest opportunity whether Congress is allowing or planning to allow the $500,000,000 needed to carry out this plan."

Notion That Aeroplanes Might Become Obsolete Before Deliveries Are Made Is Unfounded

Mr. Henry Woodhouse points out that besides supplying the aeroplanes with which to strike Germany, America can by supplying these aeroplanes release tens of thousands of trained British and French aeronautic mechanics and workers, and make up the personnel for additional aero squadrons at the fronts.

There is a notion that if we start out to supply 25,000 aeroplanes of a type, those aeroplanes would be old before they can be delivered to France. That notion is unfounded, because aeroplanes having different speeds, ranging between 60 miles an hour and 120 miles an hour are being used for different purposes, and if we start out to build 25,000 aeroplanes having a speed of between 90 miles and 110 miles an hour, they could be used easily any time they are obtained. The essential thing is to have those machines with a good factor of safety and to have a sufficient number of any one type to make it possible to supply a number of aero sqaudrons continuously. The aeroplanes used for spotting artillery fire need not have a speed of more than 80 miles an hour, and the same machines can be used for the very important work of photography. Provided only twenty per cent of the machines in use are fast battleplanes used for fighting the German aviators, the other machines are used in connection with artillery and infantry operations, photography, etc. So it would be safe to place orders for thousands of machines of a given type with the present aeroplane manufacturers, and place orders with other manufacturers for thousands of another type. Provided the machines have a factor of safety of from 4 to 6, and have reliable motors, there would be no danger of their losing any percentage of the factor of usefulness. This truth is known by the members of the Aircraft Production Board, and there are reasons to believe that they are about to take steps to carry out plans on this basis.

THE WAY TO BERLIN AND TO PEACE IS THROUGH THE AIR

Fifty Thousand Aeroplanes, Dropping Dynamite, Would Drive a Great Deal of the Fighting Instinct Out of Germany

(Editorial in N. Y. Evening Journal.)

TO make an impression on the public mind, a thing must be said often.

We repeat that the road to Berlin is THROUGH THE AIR.

The German line on land seems unbreakable.

The English line on the sea was unbreakable, until the Germans WENT UNDER IT.

The air above the German trenches and the German cannon IS OPEN AND FREE.

The way to fight the Germans and end the war quickly is through the air, over the German lines and inside of them.

While we are talking about this, Germany makes an impression through the air on Dover; an impression most painful and effective.

That impression is slight compared to what this country could do in a determined effort to end the war by air fighting.

Sending twenty flying machines, a hundred or a thousand, is nothing.

This country should keep busy in the air above German territory, traveling the free and open road, not a hundred or a thousand, but twenty thousand flying men armed with dynamite, and then another twenty thousand—and then FIFTY THOUSAND more.

If we can send a million men on foot, and in ships, we can have fifty thousand of them provided with flying machines.

A flying machine does not cost so much more than an expensive automobile.

Germany is about as big as Texas. Sixty millions of human beings are crowded into Germany.

Fifty thousand flying machines dropping dynamite every day and every night into that population would suggest peace thoughts and accomplish the end ECONOMICALLY.

That would be a war economical in money, economical in life.

There will be no trouble finding men to go up in the machines. They can be trained in three months. And while they are being trained, the flying ships can be built.

ENOUGH aeroplanes—fifty thousand of them—dropping dynamite bombs daily would DRIVE A GREAT DEAL OF THE FIGHTING INSTINCT OUT OF GERMANY—and help along peace.

The way to Berlin and to peace is through the air.

THE NEWS OF THE WEEK

Ten Army Fliers Bombard New York City with Appeals for Liberty Loan Aid

New York—Hundreds of thousands of circulars urging the purchase of Liberty Bonds, with the legend, "This was dropped by a Government aviator. It might have been a German bomb. To avoid bombs buy bonds," printed in red ink across the face, were scattered over New York June 7 from ten army aeroplanes. Much of the time the aviators were hidden from the city by cloudbanks, and part of the time they were above a rainstorm.

The work for the aviators and the volunteers who ascended with them to throw over the circulars was decidedly unpleasant. Low-lying clouds and the rain had the effect of emphasizing the lesson the scattering of the circulars was intended to teach: the possibility of assault by aeroplanes hidden from sight. The spectacle was much more impressive than if clear weather had enabled the thousands who looked for the machines to see them clearly at work.

Eight of the machines started from Mineola, picking up two others at Governor's Island. The machines lined up at 1 o'clock, in charge of Captain Wehren, Lieutenant Coyle, Captain Carroll, Lieutenant Stevenson and Messrs. Bownes, Acosts, Bjorkland and Adams. Ten minutes later Captain Kliner, in charge at Mineola, gave the signal, and the first of the machines with its fifty pounds of circulars was on its way.

As the aeroplanes approached Governor's Island two others ascended to join them. When the Battery was reached the machines separated, each covering an assigned part of the city.

An hour later saw the work done and the machines on their way back to Mineola or Governor's Island. The average distance covered was about fifty miles, done in about as many minutes.

Frank H. Russell on Automotive Committee Council of National Defense.

Mr. Frank H. Russell, president of the Aircraft Manufacturers' Association, has been appointed a member of the Automotive Committee of the Council of National Defense.

Mr. Russell has been identified with the aircraft industry for a number of years, is now the manager of the Burgess Company, of Marblehead, Mass., and is especially qualified to meet the requirements of the office.

His early experience and his ability that has enabled him to keep well in advance of the extraordinary growth of the aircraft industry, during the years when clear thinking and aggressive enterprise were essential to success and brings to the Council of National Defense a fund of knowledge and experience that is of a high value.

Mr. Russell has fully demonstrated his ability to meet the unusual conditions attendant upon the startling growth of an industry, heretofore not appreciated by the public at large. And by the consistent application of time, energy and thought, coupled with some considerable personal sacrifice, Mr. Russell is equipped with qualifications that make his appointment to the Automotive Committee a circumstance of great satisfaction to the aircraft industry and its allied trades.

Aerial Coast Patrol Unit No. 3 Decides to Increase Its Membership to Thirty-Six

Aerial Coast Patrol Unit No. 3, which has its training station at Mastic on the south shore of Long Island, has decided to extend its membership to thirty-six members to admit a number of college men who are anxious to take up aviation training immediately and equip themselves to be of utmost use to the Government.

Mr. Clinton David Backus, the organizer of Unit No. 3, who was chairman of the Debating Committee of Yale, communicated with the Aero Club of America, asking that college men who wish to join the Unit communicate with him at Mastic, L. I. The original unit which took the Federal oath and had been enrolled in the Naval Flying Reserve started training at the station established on the estate of Mr. J. P. Knapp at Mastic, L. I., three weeks ago with twelve members. The membership is now increased to fifteen, which is divided into three different committee as follows:

Executive Committee: Clinton D. Backus, Harold Pumpelly, William J. Connors, Jr.

Finance Committee: Harold Howe, Thomas Dixon, Jr., Irving Paris.

General Committee: Leslie McNaughton, Duncan Forbes, William Hamilton Gardner, Austin Feuchtwanger, Stewart Johnson, Joseph Knapp, John Laird, Bruce Campbell.

The Unit has three aeroplanes and the expenses of the training is defrayed entirely by the members of the Unit. Mr. E. J. Jaquith is the instructor, with Mr. David Dunlap assisting him. Mr. Backus, although he has only had short training, is already flying alone.

A few days ago Mr. Jaquith and M. Pompelly flew from Atlantic City to New York making a speed of two miles a minute. On June 4, when the Cedarshore Chateau burned, aviators from Aerial Coast Patrol Unit No. 3 flew over to help to put out the fire.

Applications for admission in Aerial Coast Patrol Unit No. 3 should be addressed to Mr. Clinton D. Backus, Organizer Aerial Coast Patrol Unit No. 3, Mastic, L. I.

Rear Admiral Robert E. Peary, chairman of the National Aerial Coast Patrol Commission; Alan R. Hawley, J. F. Knapp and Henry Woodhouse are co-operating with Aerial Coast Patrol Unit No. 3 to develop an efficient aerial coast patrol service.

Army and Navy News

A bill authorizing the President to take possession of, on behalf of the United States, and to use as sites for permanent aviation station for the Army and Navy, the whole of North Island, in the harbor of San Diego, Cal., was introduced in the House on June 6 by Chairman Dent, of the Committee of Military Affairs. The property will be appraised and the value adjusted by a board of real estate experts. This site was one of those recommended in the report of the Commission on Navy Yards and Navy Stations whose report was noted in our last issue (page 1307).

Civil Engr. F. H. Cooke, U. S. N., has been detailed to take charge of the construction of buildings at seven aviation stations along the coast. It is estimated that $100,000 will be expended at each of the sites, which are as follows: Montauk Point, L. I.; Rockaway Beach, L. I.; Cape May, N. J.; Philadelphia, Pa. (Navy Yard); Old Point Comfort, Va.; Key West, Fla., and near Colon, C. Z.

Instructions have been received at the headquarters of the Southern Department at Fort Sam Houston, Texas, to establish at the aviation camp there twenty-seven aero squadrons. These are to be of a strength of 150 men each, giving a strength to the camp of 4,050 men. There are to be twenty-four aeroplanes to each squadron, making a total of 648 aeroplanes for the San Antonio Aviation Camp. There are twelve machines in use in each squadron and twelve held in reserve. Forty-five hundred recruits have already been enlisted for the camp and these are being sent from all parts of the country. Capt. S. W. Cook, Cav., U. S. A., is the commanding officer of the aviation camp.

Capt. Leo. G. Heffernan, 3d Aero Squadron, S. C., to Aviation School, San Antonio, for duty. (May 25, S. D.)

Capt. John N. Reynolds, Av. Sec., S. C., to Fort Sam Houston, Texas, for duty. (May 25, S. D.)

Capt. Paul L. Ferron, junior military aviator, S. C., detailed as aeronautical officer of the Southern Department, vice Major Townsend F. Dodd, S. C., relieved. (May 31, War D.)

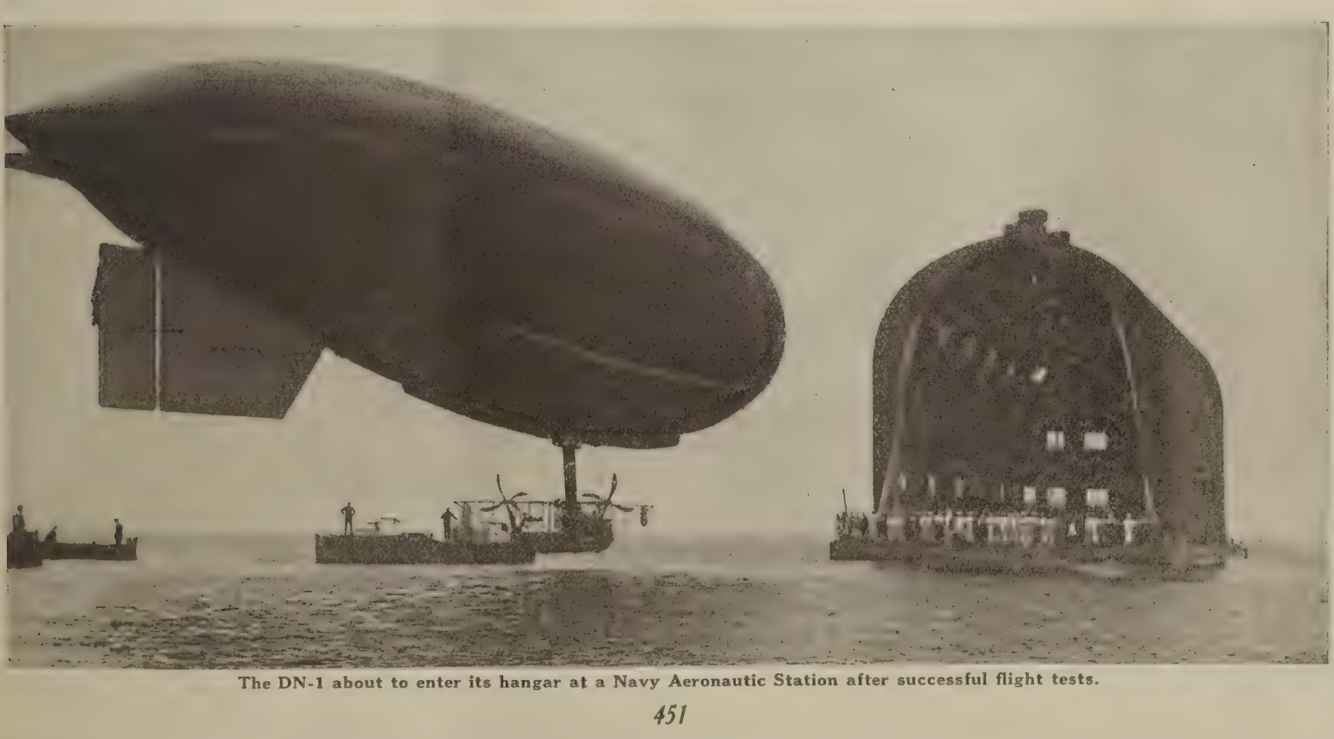
So much of Par. 28, S. O. 111, May 14, 1917, War D., as relates to Capt. Charles C. Benedict S. C., is revoked. (May 31, War D.)

First Lieut. Howard P. Culver, Av. Sec., S. O. R. C., to active duty at Fort Sam Houston, Texas (May 28, War D.)

Capt. J. L. Dunsworth and 1st Lieut. Patrick Frissell, Av. Sec., S. C., to Fort Sam Houston for duty. (May 28, S. D.)

First Lieut. W. N. East, Av. Sec., S. C., to Columbus, N. M., duty 1st Aero Squadron. (May 21, S. D.)

The following retired enlisted men, S. C., to active duty in their grade, June 1, and to the institutions indicated as instructors of aviation students: University of California, Berkeley, Cal., Master Signal Electrn. Milton N. Wil-



The DN-1 about to enter its hangar at a Navy Aeronautic Station after successful flight tests.

liams, Gardenia, Cal.; University of Texas, Austin, Texas, Sergt. 1st Class Harold A. Wise, Big Bend District, Marfa, Texas; Boston Institute of Technology, Boston, Mass.; Sergt. 1st Class Anthon J. Flynn, 228 South Main street, Dayton, Ohio; University of Illinois, Urbana, Ill., Sergt. 1st Class Samuel B. French, Post-Office Box 183, San Diego, Cal.; Cornell University, Ithaca, N. Y., Sergt. 1st Class John A. Horn, Fort Sheridan, Ill.; Ohio State University, Columbus, Ohio, Sergt. 1st Class William B. Cox Post-Office Box 168, New Orleans, La. (May 28, War D.)

Master Signal Electrn. Robert Robertson to San Antonio, Texas, for duty. (May 21, S. D.)

Sergts. 1st Class (S. C.) Richard H. Greyfield, Arnold Ruef and James E. Stewart, and Corpls. William A. Laughery and Albert V. Neven, Canal Zone, to San Antonio, Texas, for duty. (May 28, War D.)

Sergt. 1st Class Newt Frey, S. C., San Diego, to Hampton, Va., for duty at Aviation Station and Proving Ground. (May 22, War D.)

Major Henry B. Hersey, Av. Sec., S. O. R. C., to active duty at Balloon School, Fort Omaha. (May 31, War D.)

Officers of Aviation Section, S. O. R. C., to active duty; report in person to commanding general, Southern Department, for assignment: Capt. Max C. Fleischmann, Capt. Pierre DeL. Boal, 1st Lieuts. Daniel P. Morse, Stephen H. Noyes, Philip J. Roosevelt and Daniel Buckley. (May 29, War D.)

First Lieut. Daniel Buckley, Avia. Sec., S. O. R. C., to active duty, Fort Sam Houston with an aero squadron. (June 2, War D.)

Belgium to Send War Mission

Belgium is to send a "war mission" to the United States. It will consist of Baron Ludovic Moncheur, Chief of the Political Bureau of the Belgian Foreign Office; General Leclercq, cavalry officer; M. Hector Carlier, head of the Italian and Belgian Banking Company; Major Osterbreith, of the Belgian army and former attaché at Petrograd; and Count Louis Ursl. Baron Moncheur was Belgian Minister at Washington for eight years. Previously he was Minister to Mexico, where he married a daughter of the late Gen. Powell Clayton, then American Minister at Mexico City. The mission of the Belgians will be the same as that of the other Allied commissions. Among other things its members will make arrangements for the advance of further credits.

Aviation Attache is Cited by France.

Major William S. Mitchell, aviation attache of the American military mission to France, has been cited in the general orders of the French army for efficiency and bravery in face of the enemy. This is the first citation of a regular American army officer since the war began.

Major Mitchell for several weeks has been at the front getting battle experience. In the course of a French infantry attack he made a daring and successful reconnaissance, flying close to the ground at much risk. The flight had much to do with the success of the French attack. He is a member of the American Signal Corps and for several years has been attached to the United States General Staff.

Pvt. Gerveys Grylls, Signal Corps, now at Signal Corps Aviation Station, Essington, Pa., will be discharged by his commanding officer, for the convenience of the Government. This soldier is entitled to traveling allowances.

First Lieut. Carlyle H. Wash, Six Cavalry, will proceed to Fort Bliss, Tex., and report in person to the commanding officer, with a view to his examinations to determine his physical qualifications for detail in the Aviation Section, Signal Corps, and upon the completion of examination wil return to his proper station.

Sergt. First Class Newt Frey, Signal Corps, Signal Corps Aviation School, San Diego, Cal., will be sent to Hampton, Va., for duty at the Signal Corps Aviation Station and Proving Grounds.

Capt. James C. McCoy, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty. He will proceed to Washington, D. C., and report in person to the Chief Signal Officer of the Army for duty.

Each of the following named officers will report in person to Maj. Frank P. Lahm, Signal Corps, president of the board of officers appointed to meet at the Signal Corps Aviation School, San Diego, Cal., for examination to determine their qualifications for rating as junior military aviators:

Capt. Guy L. Gearhart, Coast Artillery Corps; First Lieuts. Thurman H. Bane, Eighth Field Artillery; Claude K. Rhinehardt, Seventeenth Cavalry; Norman W. Peek, Infantry, detached officers' list; Thorne Deuel, Jr., Cavalry, detached officers' list; John C. Prince, Cavalry, detached officers' list; Harvey B. S. Burwell, Thirteenth Cavalry; Warren P. Jernigan, Cavalry; John E. Rossell, Infantry; Norman J. Boots. Tenth Cavalry; William B. Peebles, Cavalry.

Second Class of 150 Men Begins Aero Plane Training

The War Department authorizes the following:

The second class in the Government schools of military aeronautics matriculated today. This second increment of 150 men brings the number of students now training for flying up to approximately 300. The students are apportioned to the six schools situated at the universities of Texas, California, Illinois, and Ohio, and Cornell and the Massachusetts Institute of Technology.

Men are still needed for these schools, as a new class will be admitted each week. In order to apply for a commission in the Aviation Section of the Signal Corps it is necessary to write to the aeronautical officer of the nearest department headquarters or to the personnel section, Signal Corps, Washington, D. C.

A blank will be sent to the applicant, and if he seems a satisfactory candidate he will receive a notice to appear before an examining board. If he succeeds in meeting the physical, mental, and moral requirements he will be enlisted and sent to one of the Army schools of military aeronautics for eight weeks' course. After graduation he will be sent to one of the aviation schools for training in flying. As soon as the recruit passes the flying tests he will receive a commission in the Aviation Section of the Signal Corps of the Army.

San Diego Aviation Field Soon to be Government Property.

North Island, near San Diego, long under negotiation for sale between its owner, John D. Speckels, and the United States government, is at last to become the property of the government through condemnation proceedings. According to San Diego advices, the government has signified its intention of condemning the property for army and navy use and paying therefor $1,800,000. The island consists of 1,200 acres and would be used, it is understood, as a base for training and as headquarters for a coast patrol. The plans as outlined at present have divided the island into two parts. The western part, or 600 acres, will be taken over by the Navy Department, and will have a base established for the training of men in the management of seaplanes and also a coast patrol of dirigibles. The army will remain in the eastern half, where it is now established, and will also have a permanent home for the First Aero Coast Patrol.

By taking over of North Island entirely and putting it to this use, the government will train on an average of 200 military and naval aviators yearly, and a number of highly-trained civil and aeronautical engineers, and, with the entire island working to full capacity, there will be in the neighborhood of from five to eight hundred men permanently stationed there at all times.

Secretary McAdoo May Co-operate With Aero Club in Liberty Bond Offering

New York.—The Secretary of the United States Treasury Department, William G. McAdoo, has written to the Aero Club of America, stating that there is a possibility the Club may be able to get No. 1 Liberty Bond of every denomination from $10,000 down to the $10 unit, to be resold at a premium, the premium to go to the Red Cross.

The Aero Club of American wrote on May 26th to Secretary McAdoo offering to buy the No. 1 bonds of every denomination from $10,000 down to $10, amounting to $16,800, and resell them and give the premium to the Red Cross to start a fund to supply the Red Cross relief for the air service. Secretary McAdoo's answer to President Hawley follows:

"Dear Mr. Hawley:

"I have your very kind letter of the 26th of May. Your proposition that bonds numbered one of the various denominations of the Liberty Loan be allotted for resale for the benefit of the Red Cross is appealing, but I am not at all sure it is possible to carry out your wishes. Numerous requests have reached the Department for bond number one of the various denominations, some of which should receive attention, if attention is given any such requests. However, you may submit your application with assurance that same will receive consideration when allotments are made and definite bonds are ready for distribution. Of course, you understand it will be some time before it will be possible to make distribution of the bonds.

"Thanking you for your patriotic action, I am,

"Sincerely yours,

(Signed) "Wm. G. McAdoo."

New Rotary Motor.

Stamford, Conn.—A new rotary motor, which will probably be manufactured in Stamford, has been invented by a Norwalk young man, Joseph Balla. The motor, which burns various kinds of fuel, is said to be especially valuable as a source of power for aeroplanes. The principle of the motor is very simple, and it is very light and powerful. Mr. Balla has received several good offers for his invention, but has decided to manufacture it himself.

Chance Vought Organizes Company.

Chance M. Vought, the well-known aeronautic engineer and designer, has organized the Lewis & Vought Corporation, and is now completing plans for the immediate production of various types of aeroplanes. Mr. Vought's wide experience will enable him to produce a machine which should very rapidly rank among our best, and his initial effort for the new firm is looked forward to with keen anticipation.

Spokane Aviation Company Active

Spokane.—The aviation school of the Spokane Aviation Company has commenced upon an active training season, and Deb Wylie, the chief instructor, has a class of ten pupils. A Curtiss tractor is used.

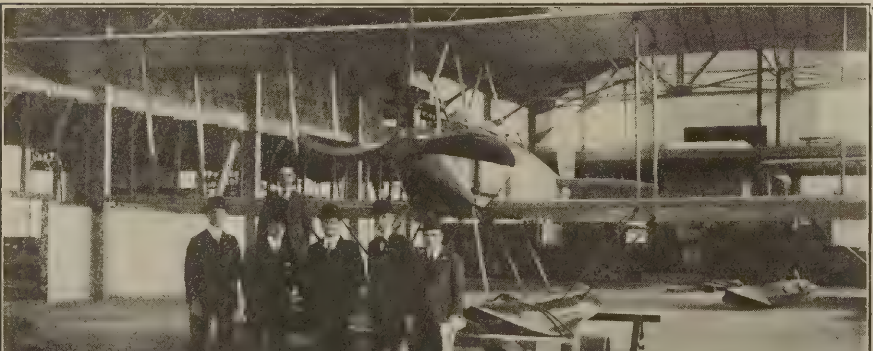
Ruth Law Drops Bombs on Cleveland.

Cleveland.—Ruth Law circled in a biplane over Cleveland on June 4, dropping "Liberty Loan bombs."

She started from Nela Park, in East Cleveland, and from a height of 5,00 feet dropped Liberty Bond literature. Thousands watched her as she circled along the lake front, crossed over the west end of the city and then traveled across the city back to the park.

Yale Aviators Fy to Long Island Fire.

Sayville, N. Y.—The Cedarshore Chateau was destroyed by fire recently. The blaze was sighted at the Yale aviation camp at Smith's Point. E. K. Jaquith, chief instructor, and a student jumped into a Curtiss biplane and flew ten miles to the beach near the first in six minutes. After helping about the fire they flew back.



A group of visitors at the Aeromarine Plane and Motor Co. factory at Keyport. Left to right, Harry B. Wise, sales manager of the company; Inglis M. Uppercu, president of the company; Alan R. Hawley, Admiral Bradley A. Fiske, and Henry Woodhouse. In the rear, R. E. de Giers, pilot for the Aeromarine Co. Mr. Uppercu has loaned the use of the Aeromarine seaplane to Admiral Fiske for the important torpedo launching tests.

Army and Navy News

First Lieut. Warren C. Woodward, Aviation Section, Signal Officers' Reserve Corps, will proceed from Memphis, Tenn., to Fort Sam Houston, Tex., and report in person to the commanding general, Southern Department, for assignment to duty with the Third Aero Squadron.

First Lieut. William W. Spain, Fourth Infantry, South Dakota National Guard, is announced as on duty that requires him to participate regularly and frequently in aerial flights from October 17, 1916.

Under the provisions of Section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt. John Stone, 1122 West Adams street, Chicago, Ill., Signal Enlisted Reserve Corps, on active duty in the Aviation Section of the Signal Enlisted Reserve Corps, to take effect May 22, 1917, is confirmed. The commanding general, Central Department, will send this soldier to Columbus, Ohio, for duty at the Ohio State University, that place.

Under the provisions of Section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Private (First Class) Alexander McLanahan on active duty in the Aviation Section of the Signal Enlisted Reserve Corps, to take effect May 23, 1917, is confirmed.

So much of paragraph 17, Special Orders, No. 108, dated May 10, 1917, as pertains to Sergt. William N. De Wald, Aviation Section, Signal Enlisted Reserve Corps, will be revoked.

Under the provisions of Section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt. Charles R. D'Olive on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, Memphis, Tenn., to take effect May 18, 1917, is confirmed.

First Lieut. Clarke Thomson, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding general, Southern Department, Fort Sam Houston, Tex., for assignment to duty with the Third Aero Squadron.

Princeton Included in University Army Training Schools

Princeton—The War Department has officially made Princeton one of the seven aviation schools which have been established through the country to give eight weeks' primary training in aviation. Two hundred students will be kept here all the time, and will undergo instruction for eight weeks in the theoretical side of aviation, after which they will attend Government flying schools.

Prof. Augustus Trowbridge, Gilbert Van Ingen, and Kenneth H. Condit left for Toronto, Can., to prepare themselves to become instructors in the school.

Aviation Camp for Atlanta in Prospect

Atlanta, Ga.—Washington dispatches to The Constitution indicate that Atlanta is to be made one of the principal training points in the aviation arm of the United States armed forces.

The definite announcement is made that the Georgia School of Technology has been designated as one of eight colleges where studies of the theory of aeronautics will be taught, and Congress has appropriated $60,000 for this purpose.

An effort is being made, and apparently with good prospects of success, for the establishment of an aviation camp in connection with the teaching of the theory of aeronautics, so that both the practice and theory may be taught at Tech.

A movement is also on foot to establish permanently in Atlanta an aviation corps of the Army, and, says a dispatch, "there is every indication that it will be carried through successfully."

In view of these latest indications of the plans of the government to utilize Atlanta's advantages as a training and concentration point, Atlanta promises to become a Salisbury plain in miniature.

It is considered especially desirable that an aviation camp shall be established at Atlanta, where the 600 to 800 students of the technological school may learn both the theory and practice of flying if they so desire.

Personal Pars

Lawrence Brown, of Venice, Illinois, has been doing some excellent exhibition flying in the Middle West during the past week.

C. O. Prest, the instructor of the Riverside Aircraft Co., Riverside, Cal., has a large class of students on hand. Miss Ruth Wightman promises to be one of his star pupils.

100 U. S. Fliers Reach France

Washington.—On the heels of news from London of the safe arrival "at an English port" of Major-Gen. John J. Pershing the Navy Department this afternoon announced the safe arrival in France of a corps of 100 naval aviators.

These aviators, who constitute the first detachment of actual fighting forces to land in France from this country, will be used in the campaign against German submarines.

The announcement of the department, given out by the Committee on Public Information, follows:

"Secretary of the Navy Daniels announced the safe arrival in France of a corps of 100 naval aviators sent there for duty in the anti-submarine operations and for any other active duty that might be given them in France.

"They are the first officers and men of the regular fighting forces of the United States that have landed in France. Lieut. Kenneth Whiting is in command.

"It is reported that the entire force is intact and that there was no sickness or casualties on the trip across.

"The corps is in charge of four highly trained officers of the Navy. A large percentage of the men are trained aviators, and the others will complete their training in France. The officers are:

"Lieut. Kenneth Whiting, United States Navy, Naval Aviator; born in Massachusetts and appointed to the Naval Academy from New York.

"Lieut. (junior grade) Godfrey DeC. Chevalier, U. S. N., naval aviator; born in Rhode Island and appointed to the Naval Academy from Massachusetts.

"Lieut. (junior grade) Virgil C. Griffin, U. S. N., naval aviator; born in Alabama and appointed to the Naval Academy from that State.

"Lieut. Grattan O. Dichman, U. S. N., naval aviator; born in New York and appointed to the Naval Academy from Georgia."

Personal Pars.

Mr. William S. (Billie) Brock, formerly chief instructor at the Beam School of Aviation, at Celina, Ohio, has severed his connections entirely from that concern and will enter the Government services in the near future. Mr. Brock did some very good work for the Beam Co. in the way of demonstrating and instructing and his many friends in Ohio are sorry that he has decided to leave.

Marconi Talks of Wireless in War

Washington—Guglielmo Marconi, Senator in the Italian Parliament, captain in the Italian navy, and inventor of the wireless, gave to the New York *Evening Post* correspondent his first interview since arriving in the United States with the Royal Italian Mission. And naturally he talked about wireless, its importance in the present war, and its future.

He was asked what he thought the greatest single accomplishment of wireless in the war.

"Its use by aeroplanes," was Signor Marconi's instant answer. "The wireless has revolutionized artillery action. Heretofore the gunner did not know whether his shot landed accurately or not. Guns are frequently placed in such a way that the hills intervening cut off any direct observation. But nowadays a big gun might be located on low ground, and actually shoot over an elevation to low ground on the other side, and be sure of its aim and range. For the wireless constitutes the eyes of the gun. Aviators remain in the air above the position that is attacked. They watch each shot. As it falls, they report back by wireless whether it is too far or too short. In less than a minute after the shell has burst the commanding officer of the artillery battery at the point of origin has a report of the shot fired by each of his guns."

Hangar Manufacturer Opens New York Office

The Steel Fabricating Company, manufacturers of hangars, specifications and illustrations of which were given in Aerial Age of June 11, has opened an office in New York at 404 Fourth avenue with C. H. Plummer, sales manager, and Mr. P. A. Bourgerie, district manager, in charge.

New England Aviation News

Lieutenant Earl W. Spencer, Jr., has taken charge of the work at the naval air station at Squantum, Mass., relieving Commander John Bliss who had been in charge temporarily.

Captain Benjamin W. Mills, of the 1st Army Aero Squadron, has been sent to the Massachusetts Institute of Technology to assist the civilian instructors in giving a month of preliminary theoretical training to reserve officers for the new squadrons that are to be created shortly.

A delegation of two hundred members of the American Society of Mechanical Engineers recently visited the aeroplane plant of the Burgess Company at Marblehead, Mass. The visitors inspected the assembling shop and the main plant and also witnessed some exhibition flying by Clifford L. Webster and Frank Common.

The War Department has decided to establish a school of balloon navigation at New Haven, Conn. It will be known as the collegiate balloon school and complete plans will be announced shortly.

The instructors at the aviation grounds at Squantum, Mass., who rank as ensigns, are Clifford L. Webster, Doyle Bradford and Philip W. Page.

Between thirty and forty men from Princeton University have arrived at East Greenwich, R. I., to take up the study of aviation under the supervision of the Galludet Aircraft Corporation. The use of land at Quonset Point for an aviation field was refused because this location will be used for the mobilization of the Rhode Island National Guard.

A demonstration of a bullet warplane will be given by the Galludet Aircraft Corporation on July 4 during a celebration to be held at East Greenwich, R. I.

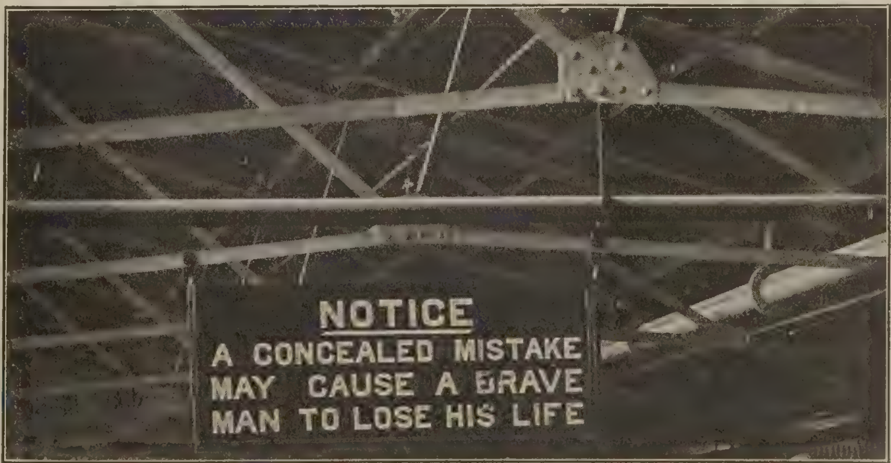
French Airmen to be Teachers Here

Paris.—Rough outlines of the plans already made for American aviators and aeroplane manufacturers to strengthen the French air service and then to aid the Ameriacn army when it arrives were given by Daniel Vincent, Under Secretary of the Ministry of War for aviation.

A dozen of France's best airmen are going to the United States to begin training American aviators, and the final touches will be put on in a new big school for Americans in France. American specialists in aeroplane building will visit France, and with the knowledge gained, are expected to speed up construction of engines on the return to the United States.

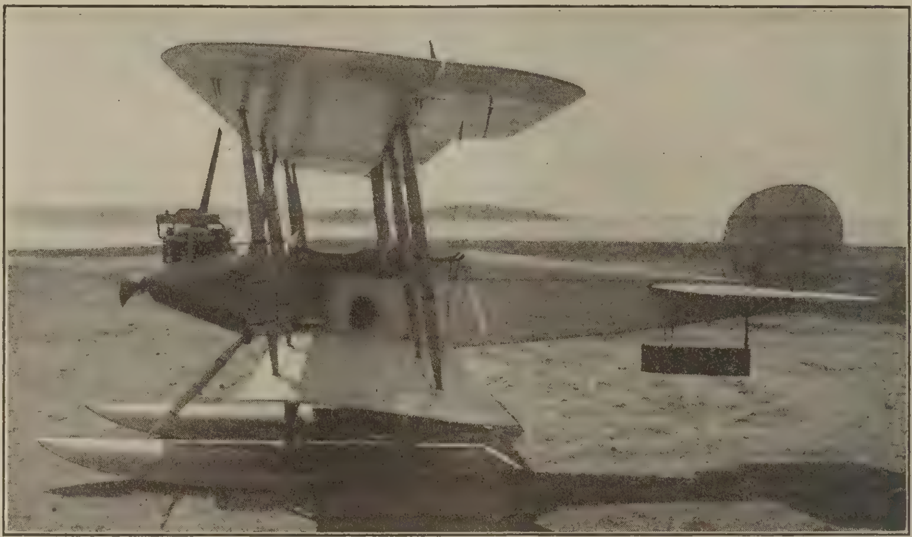
"I believe aviation was the first arm of the service to take action after the United States entered the war, to bring about active co-operation between the United States and France as regards that service," said M. Vincent. "Among the results obtained, I am sending a dozen of our best pilots to act as aids to the officers in the American flying schools.

"The pupils who graduate from these schools will be sent to one big school in France now being installed by and for Americans, where they will take the final 'perfection course.' The Americans will be trained at first purely for chaser work and bombarding. Later, when American artillery reaches the front, the American pilots will take up training to serve their own artillery."



An excellent example which should be copied by the management of every aeroplane factory, where accuracy is of such vital importance.

THE AEROMARINE TRAINING SEAPLANE



ONE of the Aeromarine seaplanes has been placed at the disposal of Rear Admiral Bradley A. Fiske, for use in carrying out experiments in launching torpedoes. Launching experiments are being made with dummy torpedoes at present and regular torpedoes will soon follow. Fine details of construction combined with lightness have resulted in a dependable plane, the performances of which make it ideal for the purpose mentioned.

Wheels may be substituted for the pontoons, for land work. The seaplane is substantially the same as the land tractor described in the March 12th issue of AERIAL AGE, except that the seaplane has a slight increase in plane area.

General Dimensions

Span, upper plane	42′-9″
Span, lower plane	34′-0″
Chord	6′-3″
Gap	6′-6″
Length over all	28′-9″
Height over all	14′-0″
Weight, empty	1400 lbs.
Speed range	77-43 m.p.h.
Motor, Hall Scott "A7a"	100 h.p.

Dihedral angle of wings, 1°; Stagger, 1′-6.″. There is no backsweep. Aspect ratio of top plane, 6.8; lower plane, 5.4. Wing curve, R.A.F. 6. Plane area, not including the two ailerons, 410 sq. ft.

The body is 22′-6″ in length; width, 34″; maximum depth, 3″-6′. Standard dual Dep control is installed.

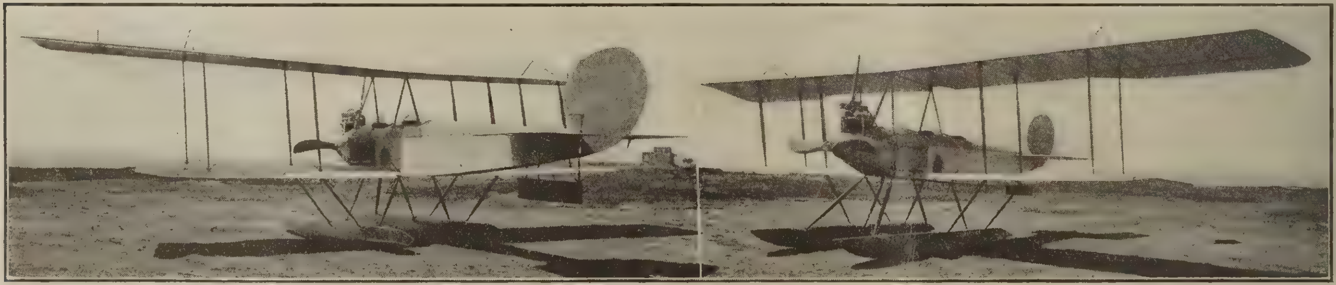
The stabilizer is double cambered, non-lifting and non-adjustable; area, 50 sq. ft. Area of rudder, which is of the balanced type, 10 sq. ft.

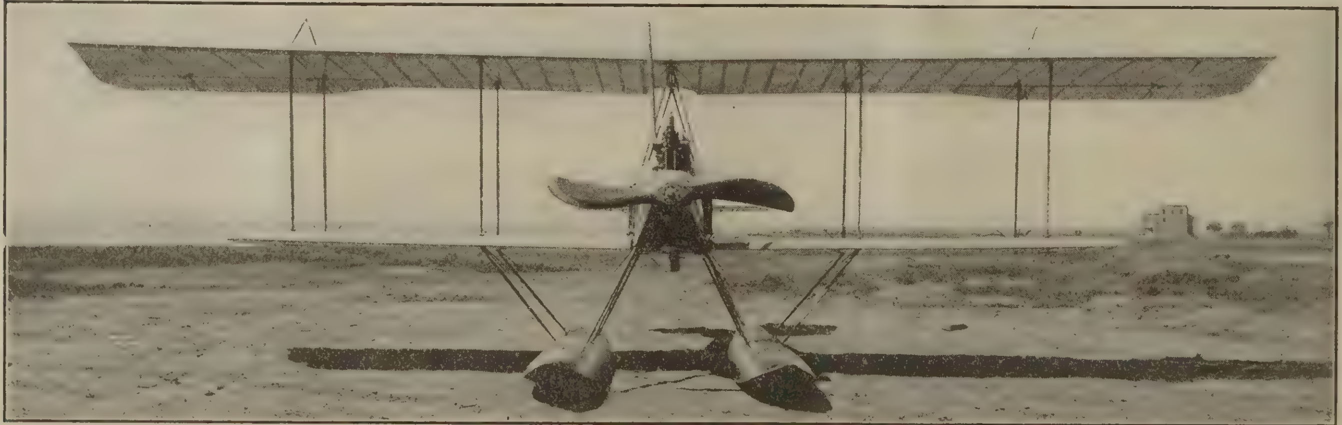
Twin pontoons are arranged catamaran style, centered 7′-0″ apart. They are of the hydroplane type with V bottoms and rounded sides and tops. Length, 16′-6″; beam, 30″; depth 17″. A 3″ step occurs 7′-6″ from the rear end of the pontoon. Air leads are built in to reduce the vacuum at the step.

Material of pontoon is spruce, ash, and mahogany, with double diagonal planking having layers of fabric between. The inside is divided into several watertight bulkheads.

The power plant in the machine shown in the accompanying illustrations consists of a Hall-Scott "A7a" 4 cylinder, vertical, four-stroke cycle, rated 100 h.p. at 1400 r.p.m. Bore and stroke, 5¼″ by 7″; weight, 410 lbs. Fuel consumption per hour, 9½ gallons. Oil capacity in crankcase, 3 gallons. Fuel is carried for a flight of 4 hours duration. The propeller is 8′-4″ in diameter.

A streamline stack discharges the exhaust gases from the motor over the top of upper wing. This protects the passengers from the gas and keeps the machine clean.





The Aeromarine seaplane. The lower illustration, direct front view, shows the very small head-resistance.

DETAILS OF ACKERMAN AEROPLANE WHEELS

Field tests of the Ackerman wheel, made at Mineola in February, showed how completely the wheels absorbed the landing shock of an aeroplane. The shock is absorbed before it reaches the axle, doing away with the exerciser cord which usually binds the axle to the landing chassis.

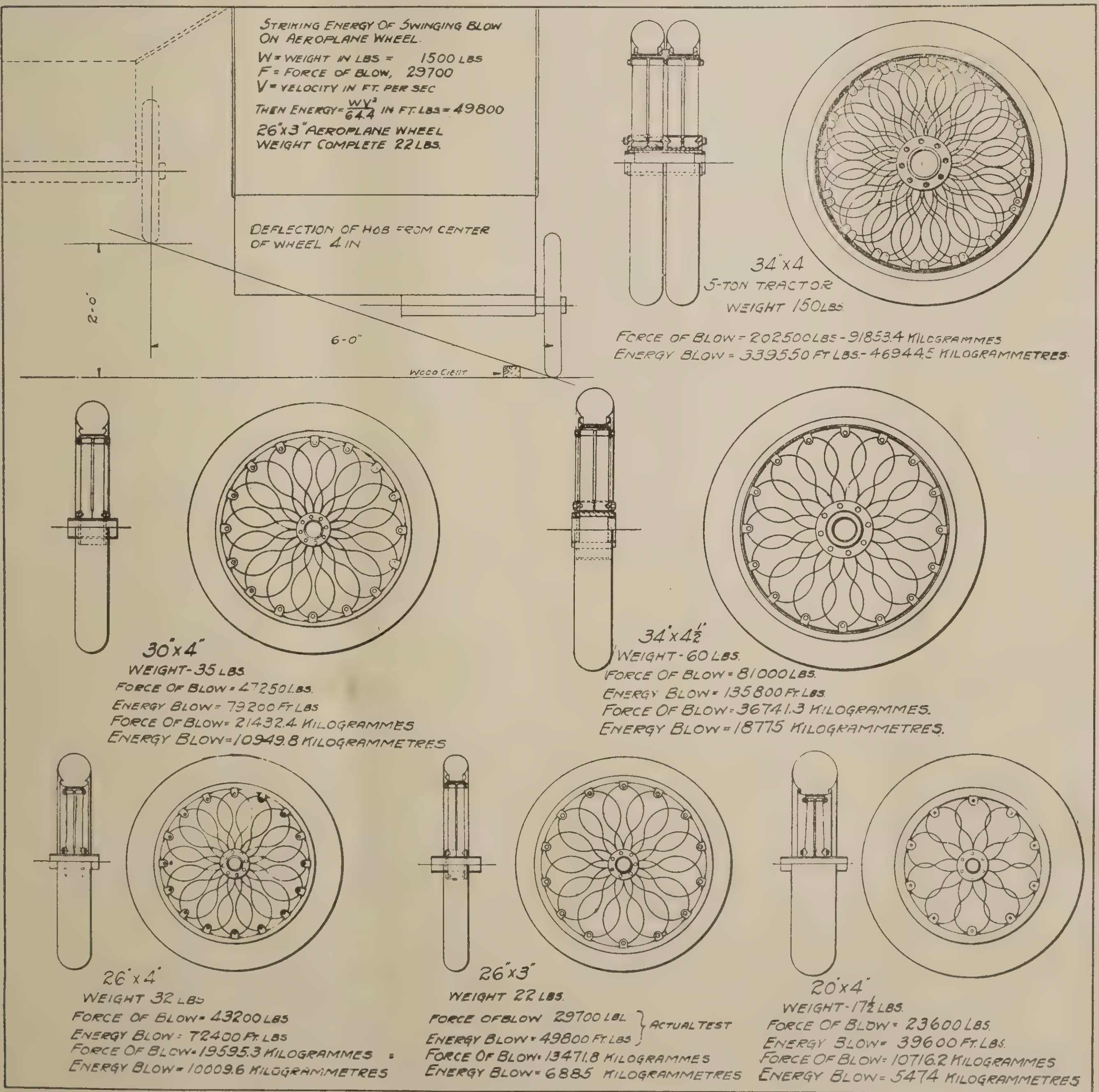
The tendency toward rebounding when alighting on the ground was noticeably absent in this wheel, the spokes of which are arranged to take care of such action.

Ackerman wheels are made in a wide range of sizes which makes possible the selection of a wheel most suitable to certain aeroplanes. The smallest size, 20" x 4", weighs but 17½ lbs., and fails only when subjected to an energy blow of 39,600 ft. lbs. The largest size, the 5-ton tractor model, size 34" x 4½", weighs 150 lbs. This wheel fails only when subjected to an energy blow of 339,550 ft. lbs.

There are four intermediate sizes, 26" x 3", 26" x 4", 30" x 4" and 34" x 4½".

The pilots who made test landings with Ackerman wheel equipped Curtiss J-N 4 aeroplanes at Mineola handed in a report of their personal observations of the shock-absorbing qualities of the wheels, which was published in AERIAL AGE on February 19th. Each of the four pilots had the highest praise of the merits of the wheel, and their recommendations of its use is noteworthy because of the fact that the tests were made for the benefit of the War Department.

Recently extensive landing tests were made of the Ackerman wheels in Canada, on behalf of the Canadian Air Services, and they were thoroughly successful in every detail—the officers in charge of the tests being very enthusiastic about the possibilities of the wheels.


STRIKING ENERGY OF SWINGING BLOW ON AEROPLANE WHEEL.
W = WEIGHT IN LBS = 1500 LBS
F = FORCE OF BLOW, 29700
V = VELOCITY IN FT. PER SEC
THEN ENERGY = $\frac{WV^2}{64.4}$ IN FT. LBS = 49800
26" x 3" AEROPLANE WHEEL
WEIGHT COMPLETE 22 LBS.
DEFLECTION OF HOB FROM CENTER OF WHEEL 4 IN
2-0"
6-0"
WOOD CLEAT
34" x 4
5-TON TRACTOR
WEIGHT 150 LBS.
FORCE OF BLOW = 202500 LBS - 91853.4 KILOGRAMMES
ENERGY BLOW = 339550 FT LBS.- 46944.5 KILOGRAMMETRES.
30" x 4"
WEIGHT-35 LBS.
FORCE OF BLOW = 47250 LBS.
ENERGY BLOW = 79200 FT LBS
FORCE OF BLOW = 21432.4 KILOGRAMMES
ENERGY BLOW = 10949.8 KILOGRAMMETRES
34" x 4½"
WEIGHT - 60 LBS.
FORCE OF BLOW = 81000 LBS.
ENERGY BLOW = 135800 FT. LBS.
FORCE OF BLOW = 36741.3 KILOGRAMMES.
ENERGY BLOW = 18775 KILOGRAMMETRES.
26" x 4"
WEIGHT 32 LBS
FORCE OF BLOW = 43200 LBS
ENERGY BLOW = 72400 FT. LBS
FORCE OF BLOW = 19595.3 KILOGRAMMES
ENERGY BLOW = 10009.6 KILOGRAMMETRES
26" x 3"
WEIGHT 22 LBS.
FORCE OF BLOW 29700 LBL
ENERGY BLOW = 49800 FT. LBS
ACTUAL TEST
FORCE OF BLOW = 13471.8 KILOGRAMMES
ENERGY BLOW = 6885 KILOGRAMMETRES
20" x 4"
WEIGHT - 17½ LBS.
FORCE OF BLOW = 23600 LBS.
ENERGY BLOW = 39600 FT. LBS.
FORCE OF BLOW = 10716.2 KILOGRAMMES
ENERGY BLOW = 5474 KILOGRAMMETRES

THE WORLD'S LATEST BATTLEPLANES

By HENRY WOODHOUSE

A squadron of German speed biplanes of the Albatros type, described in a recent issue of "The Aeroplane" as "Baron von Richthofen's Traveling Circus," on account of the variegated colors.

THE battleplane, while representing only one-fifth of the types of machines used in the present war, is the key to command of the air, because the skies must be cleared of enemy aviators before the scouts, bombing, artillery and infantry aeroplanes can work effectively. Of course, if one side could outnumber the other side, the equivalent of the fighting power afforded by the fast battleplane could be obtained by the advantage afforded by number, which makes up for having a few miles less in speed or less skillful aviators.

But neither side has been able to outdistance the other appreciably in number, therefore command of the air is still decided by speed and the pilot's skill and the pilot's ability to gain an advantageous position—like the famous Captain Boelke, who used to hide in a cloud until the opportunity was afforded to dive on one of the Allied aviators and shoot him down. If he missed he landed immediately, without seeking to outmaneuver the Allied aviator.

He used "position" as a winning factor.

As a general rule, however, speed is the basic factor for achieving command of the air, hence every effort is made to get speed—and the factor of safety in construction is only given second consideration, when it is considered at all.

Battleplanes that Collapsed in the Air

A despatch states that the German battleplanes of late have been collapsing in the air, at times without being hit, often when but slightly injured. The despatch follows in part:

With the British Armies in France, via London.—British pilots continue to bring in accounts of German aeroplanes breaking to pieces in the air soon after being attacked. That tendency has been notable for more than a fortnight. Once shot out of control the German aeroplanes have lost their wings, tails and other gear to such an extent that when they finally crash on the ground very little wreckage can be seen.

A British pilot recently flew at an enemy machine head-on manoeuvering at the last moment just in time to avoid a collision. One of the wings of the British aeroplane, however, scraped one of the German's wings, whereupon the latter began to fall. The British pilot dived after him and was startled to see the German's damaged wings fly completely off while the tail dragged as if its back was broken.

The causes are evident. In the struggle for additional speed there has been sacrificed the factor of safety. The machines are merely shells of machines.

The German machines used extensively are:

Name of Machine	Span. Top. ft.	Span. Top. in.	Span. Bot. ft.	Span. Bot. in.	Gap. ft.	Gap. in.	Chord. ft.	Chord. in.	Length. O.A. ft.	Length. O.A. in.
Albatros C. III..	39	2	37	3	5	3	6	1	26	4
Albatros Bü ...	28	4	26	9	5	3	5	9	24	0
Aviatik	41	0	35	4	6	4	6	1	26	3
Halberstadt	28	6	26	0	4	6	5	0	24	0
L.V.G.	42	10	37	10	5	6	5	10	27	0
Rumpler	40	10	36	10	5	9	5	6	26	4

The two smallest machines, the Halberstadt and the Albatros Bü, are single seaters, all the others being two seaters. Where the gunner occupies the rear cockpit it is found that in many cases that the pilot is equipped with a synchronized gun fired forward and sighted by steering the machine itself. The same applies to the single seaters. Some of the single seaters are equipped with two synchronized guns fired directly in front.

In the course of an illuminating and amusing article in the Aeroplane (London and under the caption "The Traveling Circus in Action" the following points are brought out.

"The High Command of the German Flying Service instituted some months ago the system of mobile chaser squadrons, consisting entirely of picked fighting pilots. These squadrons move en masse, as a complete unit, from place to place, and keep the air as clear as may be of hostile machines wherever they are thickest. The systm has much to recommend it as against the system of splitting a fighting squadron up among several reconnaissance or bombing squadrons so that two or three of its machines are told off at a time to protect the slower types. These German fighting squadrons are known to the R. F. C. as "traveling circuses," owing to their acrobatic abilities, and are regarded with respect, if not with awe. The first of them to become known at present are those of Capt. Bölcke and the two best known at present are those of Capt. Baron von Richthofen and Capt. von Bülow.

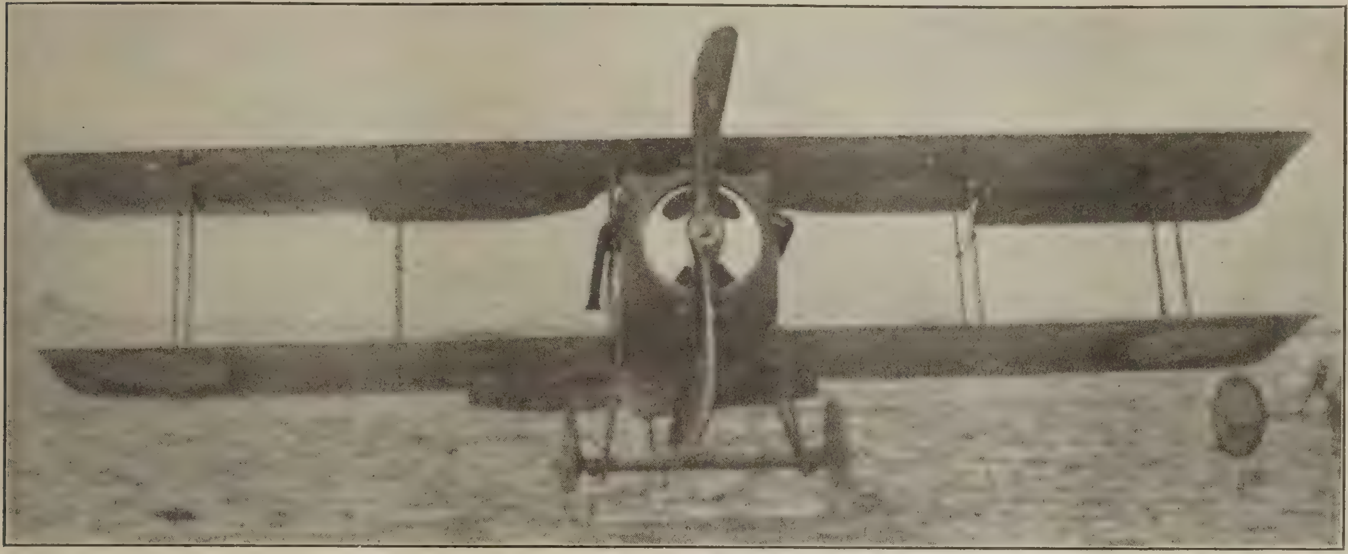
Occasionally one of them meets with a surprise just when everything seems easy, and one of these surprises was rather well described by the Special Correspondent of the "Times." Writing from War Correspondents' Headquarters on May 8, he said that six of our aeroplanes started out, but one had engine trouble, so only five were there when the enemy appeared.

It was on May 5, and there was a thick haze, so that the ground was almost invisible from 2,000 feet. Our men had started fairly late in the afternoon and at 5 o'clock were well over in enemy country, when, with the sun at their backs, they saw two enemy machines ahead. They tried to close with the enemy, who made some show of giving fight. The tactics suggested that the two enemy machines were only a decoy. Even as our men started to chase the two flying enemies, out of the haze on all sides new fleets came closing in.

The new arrivals flew in three formations, two of which contained eight machines, and the third contained nine, making twenty-five German aeroplanes, all of a uniform fighting type, to whom the other two, which now ceased to run away, joined themselves, making a minimum of twenty-seven machines in all.

Cutting out much adjectival, matter, which is pure journalese and does not materially assist the narrative, the "Times" account runs thus:

One of the enemy fleets, taking advantage of the thick air, had passed behind our little squadron and came at it, straight between



Front view of the much discussed "Spad," one of the most efficient speed scouts of our Allies, and one of which has recently been received in this country.

it and the sun. The other two fleets came from the southeast and northeast. As they approached they spread out so that our men were ringed round with enemies on every side.

The fight began at about 11,000 feet, but in the course of the things that followed it ranged anywhere from 3,000 to 12,000 feet. And an extraordinary fact is that, all the while that it went on, the German anti-aircraft guns below kept at work. Usually, as soon as aeroplanes engage overhead, the "Archies" are silent for fear of hitting the wrong man.

Primarily, any such general mêlée inevitably breaks up into a series of individual fights.

"Formation," as it is technically known, breaks up, but nothing could have surpassed the way in which our men fought. Not one of them allowed himself ever to be cut off and isolated from the rest. This is the more remarkable as, with the exception of the Flight Leader, all the pilots were practically new men, with little experience of fighting. Some had only been in France a fortnight. As for the Flight Commander himself he, still a youth, may fairly be called a veteran, for in that battle he reached his seventeenth German victim.

The actual fighting lasted from 5 to 6 o'clock, an extraordinary time for such a thing. The fight had lasted but a few minutes when an enemy machine, which Capt. A. had attacked, went down in flames, with the wings of one side shot away. Then Lt. B. caught his adversary at close range, and the German aeroplane went down turning over and over as it fell. Lt. C. scored next, his enemy's machine spinning plumb down to where, somewhere below the haze, it must have crashed.

Lt. B.'s engine gave out and he was "compelled to leave the formation," and, as he fell, an enemy went after him. Lt. C. saw the German diving after, and before the German could do his work, the British aeroplane was almost touching the tail of his machine, and the German turned clean over in the air and crashed.

Then B.'s engine caught its breath again, and B., who was one of those who were new to the game, climbed and rejoined formation. Some 8,000 feet he had to climb, with the baffled "Archies" blazing at him from below. Just as he "rejoined" another German fell. It was A.'s second victim.

Then once again it seemed that a throw had gone against us, for still under control, but with flames bursting from its reserve petrol tank, one of our machines began to drop. Again an enemy dived for the flaming ruin as it fell, but quicker than he, A. also dived and while our crippled machine still belching flames slid off, with its nose set for home, the German, mortally hit, dropped like a stone.

It was just retribution. The unwritten laws of this marvelous game prescribe that no honorable fighter attacks an enemy in flames. Such an enemy is out of the fight and has trouble enough for a brave man. The German who dived for our burning machine knew that he was doing an unchivalrous thing, and it may be that that knowledge unnerved him so that he paid the penalty.

Strangely enough, our burning aeroplane got home. I have seen the wreckage, with the reserve petrol tank on the roof bearing two bullet holes on one side and great ragged tears on the other where the bullets passed out. The flames had burned away the whole central span of the upper plane. The thick rear main spar was charred and burned through and two ribs were completely severed and hung with loose blackened ends. Yet, like a great blazing meteor, it crossed our lines and came to earth, not indeed at its own home, but on safe and friendly ground; and as another aviator said to me in admiration, "He made a perfectly topping landing."

Lt. D. emptied a belt from his machine gun into an enemy when so close that his wings almost brushed the other's rudder, and the enemy turned turtle, clear over on his back, and, spurting out a thick column of black smoke, went down.

Some of the enemy were already drawing off, but our men were in no mood to let them go, and before the enemy could disentangle itself from the battle, two more of their machines had gone to earth—one, his third in the fight, falling to Lt. C. and one to Lt. E. Then the last four of our machines came home.

It is deduced by the R. F. C. unit, of whom the "Times" man was a guest, that the German formation belonged to von Bülow's Circus.

Our Variegated Foes

Mr. Percival Phillips, of the "Daily Express," writing on May 10 of the German fighting aeroplanes, says that the R. F. C. pilots now find that the Hun pilots are indulging in highly decorative if not precisely protective coloring:

"It is like going out to fight birds of Paradise," said one scout, who complained facetiously that the dazzling tints of the Albatros and Aviatik machines nearly blinded him. Never has there been such an orgy of kaleidoscopic effects on the earth or above it. The Hun has taken to daubing his machines fantastically, after the manner of a savage who hopes to frighten his foe to death. A child let loose with a box of paints could not achieve more lurid results.

A Morane monoplane flown by one of the members of the Lafayette Escadrille.

Edward F. Hinkle, of the Lafayette Escadrille, standing in front of the first aeroplane to carry the American flag over the French lines a "Spad."

One British aviator who went out the other morning to search for trouble found it with a red body and wings that were green on top and blue underneath. One German squadron encountered recently was composed of machines painted white, red and green and one of khaki color, with greenish gray wings. Individual fliers have included a green aeroplane with a yellow nose, another with a red body, green wings and yellow stripes, another with green body and yellow wings, another with scarlet body, brown tail and reddish brown wings, with white crosses on a bright green background, another with yellow body and red wings, with light blue tips, a black machine with white markings, a machine with one green and one white wing, and others with silver discs, yellow noses and blue tails.

These harlequins of the air are apparently decked according to the taste of the pilots. Their gaudy dress has offended the artistic sensibilities of more than one British flying man who has succeeded in obliterating these specimens of decorative skill.

"When I see a Boche with a yellow and red nose, blue wings and a green tail," said one youthful pilot, "I want to kill it. It is not so much a question of war as of common decency. They spoil the sky."

The characteristics of these machines, like the characteristics of the Allies battleplanes change continuously. It is a continuous striving for speed, in which everything else is sacrificed. The Vickers battleplane, which was brought to the United States recently showed evidence of "shaming." It had a low factor of safety of about 2, with a speed of 126 miles an hour maximum. It was a splendid climber.

The more familiar type of Nieuport was the monoplane, which was noted for its speed, and to meet the demands of modern warfare the Nieuport biplane scout was devised, embodying the well-known reliability of the Nieuport practice with features new to biplane construction.

The very narrow lower plane permits of a good range of vision and with only two Vee struts between planes a number of struts and wire braces are done away with. The characteristics of the Nieuport are:

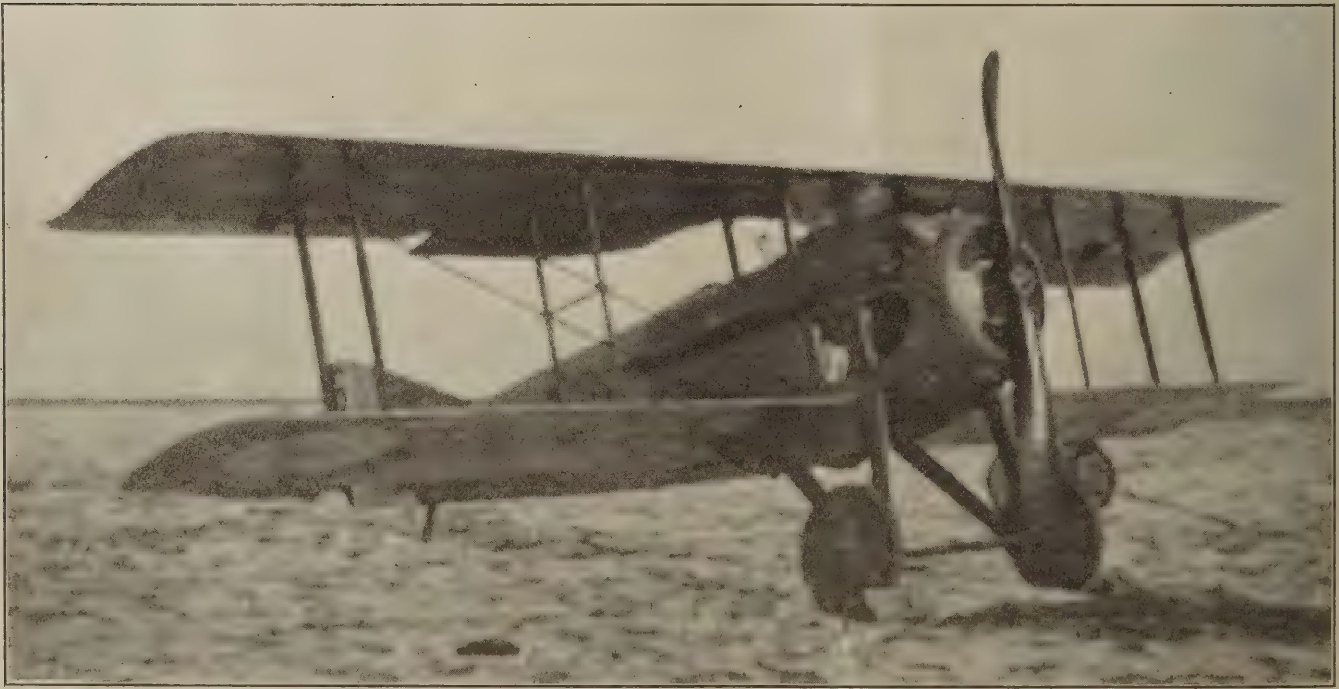
Span, top plane	24 ft. 6 in.
Span, bottom plane	23 ft. 0 in.
Chord, top plane	3 ft. 11 in.
Chord, bottom plane	2 ft. 4 in.
Gap	4 ft. 2 in. to 3 ft. 5 in.
Plane area	145 ft.
Length over all	18 ft. 6 in.
Motor	Le Rhone 80
Propeller	Helice Levasseur

The Spad has been an improvement on the Nieuport in speed without further cutting down the already low factor of safety. This is due to its splendid lines and the Hispano-Suiza motor. The accompanying photographs show different views of the Spad.

The "Spad" has been constantly changed and improved. The machine as it first appeared is shown in the line illustration, and it was recently described in the Patent Journal as follows:

1,228,390. AEROPLANE. Louis Béchereau, Paris, France, assignor to The Society "Spad Societé Anonyme pour l'Aviation et ses Derivés," Paris France. Filed Feb. 1, 1916. Serial No. 75,528. (Cl. 244—30.)

1. An aeroplane or other air craft apparatus comprising a fuselage, a tractor propeller mounted in front of the fuselage, and an observer's car having means for remov-



Another view of the "Spad" equipped with the Hispano-Suiza 160 h.p. motor ably mounting it in an overhanging position in front of the propeller.

2. In an aeroplane, the combination with a unit comprising a landing frame, a fuselage, and a tractor propeller mounted in front thereof, of another unit comprising an observer's car constructed separately from the unit first mentioned and mounted in front of the propeller and having arms securing it to the landing frame of the first-mentioned unit.

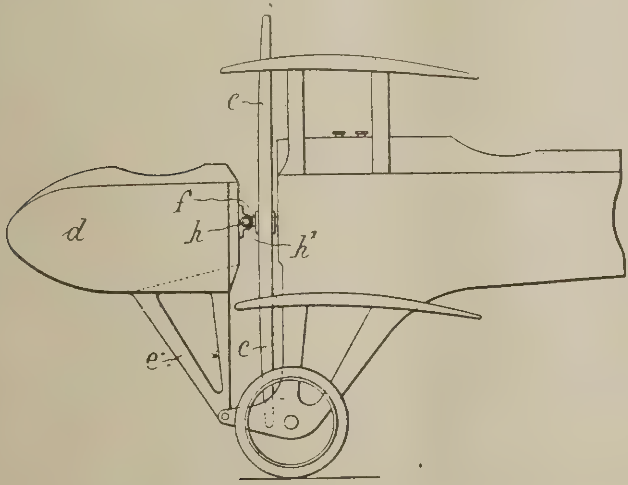
3. In an aeroplane having a landing frame, a fuselage, and a tractor propeller mounted in front thereof, an observer's car mounted in front of the propeller and having means connecting it to the forward end of the propeller shaft and also having means connecting it to the landing frame.

4. In an aeroplane, the combination of a landing frame, a fuselage, and a tractor propeller mounted in front of the fuselage, of an observer's car having a pair of arms pivoted at their lower ends to the landing frame and arranged in the same plane with the uprights of the landing frame.

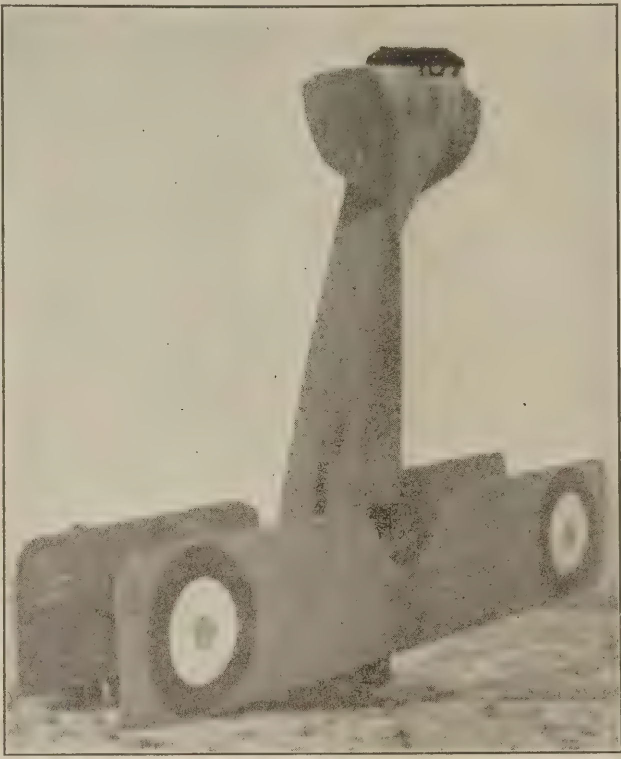
5. The combination with an aeroplane having a fuselage, and a tractor propeller mounted in front thereof, of an observer's car mounted in front of the fuselage and having means for connecting it to the forward end of the propeller shaft.

The Curtiss Triplane—a Scientific Solution of the Problem of Getting Speed and High Factor of Safety

Curtiss has solved the problem of getting the high speed with the low landing speed and high factor of safety by making a triplane. The additional plane affords sufficient increase in carrying capacity to lift the additional weight of stronger construction, and also makes slower landing possible, without much additional head resistance.



The drawing that accompanies the "Spad" patent.



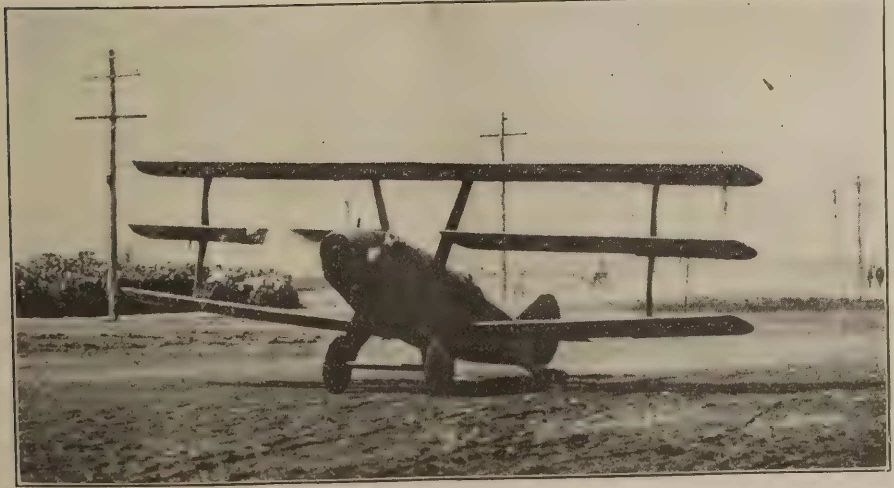
The value of this photo is that it affords an exceptional view of the lines of construction of the "Spad." The pilot of the machine wrote the most appropriate caption for this picture when he subscribed on the back of the photograph "Rotten Landing."

The Curtiss triplane could make 130 miles an hour with the larger Curtiss motor. The Army limited the power of their Curtiss triplane to the smallest Curtiss motor, which makes it possible to get the very remarkable speed of 114 miles an hour.

Having a high factor of safety this machine makes a perfect training machine for training aviators preliminary to their flying the types used on the battlefronts.

While the censor has not permitted us to publish details, it is well known that the Sturtevant Aeroplane Co. has constructed pursuit monoplanes that have showed up excellently in the matter of speed in their tests. And recently a hydroaeroplane constructed by the Burgess Company at Marblehead made a speed of something better than a hundred miles per hour. This type is illustrated herewith.

A number of other American manufacturers are ready to build battleplanes, some have developed remarkable types, which should be built. There is no reason why America should not supply the Allies with thousands of battleplanes.



The Curtiss triplane speed scout, which has a low landing speed and a high speed of 114 miles per hour equipped with only 90 h.p. motor, while it has a factor of safety of six. With 160 h.p. this machine would easily give 130 miles an hour, without having to cut down the factor of safety. The secret is in the triplane construction.

STEEL IN AEROPLANE ENGINE CONSTRUCTION

By PROFESSOR CHARLES E. LUCKE

THE problem of the aeroplane engine appeals strongly to every engineer because it is a problem of the lightest power plant. The lightest weight of engine proper per horsepower is to be secured first by obtaining maximum mean effective pressure at maximum speed; in other words, the product of a mean effective pressure and speed must be a maximum. At the same time the weight of metal per cylinder, or per cubic inch of cylinder displacement per working stroke must be a minimum—and with both of these factors the engine must be reliable in operation. So far, this reliability factor has been weakest, though lightness has been secured in engines good for short periods of running.

Not only must the metal weight of engine per horsepower be a minimum, but in addition the fuel weight to be carried must also be a minimum because, as can readily be seen, the fuel weight necessary for flights of any length predominates over the engine weight. For example, taking a half pound of fuel and oil per hour per horsepower as a fair value, it is readily seen how quickly that will catch up on engine weight when the latter is 4 to 5 lb. per horsepower.

In undertaking an analysis of the aeroplane-engine problem from the records, the only conclusion that can be drawn is along the line of type. Data are almost entirely lacking. On the question of general engine types, attention might be called to a few points:

The air-cooled motor has entirely failed in comparison with the water-cooled motor—the reasons are perfectly sound and secure. The two-cycle engine has given way to the four-cycle type.

Fixed Cylinders Prevail

Fixed cylinders have prevailed over rotating cylinders. Odd cylinder arrangements of queer, freaky forms have all been relegated to the scrap heap in favor of a few modern arrangements. The standard cylinder arrangements of to-day, which are the survivors of what may be called the inventive period, or at least the first inventive period, and the six and eight cylinders in line and the eight, twelve and sixteen V's.

It really appears therefore that the one valuable result of all our experience has been the selection of a few typical arrangements which we are now compelled to study, as minutely as circumstances permit, for the purpose of standardizing and mechanically perfecting these particular types as standard machines which will run as reliably as our stationary engines and which can be manufactured as economically.

Taking up each of the factors of aeroplane-engine design that seems important, in as specific a way as seems proper, the first one I wish to consider is the value of efficiency and the relation of efficiency to minimum weight.

Plotting hours of running as abscissæ against weight of engine with fuel and oil, as ordinates for the air-cooled and the water-cooled types of motor, respectively, so that the intercept on the vertical axis represents the weight of engine metal alone, and the ordinates away from the axis represent the weight of metal plus fuel and oil, one finds that the two curves cross at some period of running beyond which, therefore, the water-cooled heavier engine, because of its lower fuel consumption, becomes lighter in comparison.

The metal weight of the water-cooled motor is about one and one-half times that of the air-cooled motor, and the slope of the combined-weight line of the latter compared with that of the former is as two is to one—that is to say, the consumption of the air-cooled motor is approximately twice that of the water-cooled motor. These facts are responsible for the crossing of the lines.

Homogeneity of Mixture

Of the conditions for efficiency which bear upon this question of fuel weight, and which have led to the selection of the water-cooled motor as a type, the first is the compression. The higher the compression the higher the efficiency, and there is no limit until preignition occurs. Statements will be found in textbooks to the effect that there is a limit, but they are the results of mistakes in interpretation, and are erroneous. The amount of compression possible is limited, however, by the metal temperature and by the temperature of the mixture as admitted. Naturally, the warmer the mixture during suction, the sooner it reaches ignition temperature by compression. Therefore, suction heating is a limit. Again, the interior metal temperature, if it is high (as it is always), may cause trouble by the contact with the mixture during compression, and some portion of the mixture may be brought to its ignition temperature by hot-wall contact long before the main mass is brought to this ignition temperature by compression alone. It requires only one such hot spot to wreck a well-laid plan.

The next factor in efficiency is the mixture quality, and in this there are the following controlling elements: first, mixture proportions. Any excess fuel means direct waste, but it also means carbonization and fouling. Excess air quickly makes the mixture practically non-burnable. Therefore, mixture proportions must be accurately controlled—more accurately than is possible with any existing carbureter. Carbureters are not yet satisfactory, and as soon as satisfactory carbureters are secured from the standpoint of proportionality of the mixture, we may expect to see a further reduction in fuel consumption and more reliable operation.

Dryness of mixture is a matter of co-ordinate importance with mixture proportions. When mixtures are wet, that is, not completely vaporized, the air and fuel cannot be uniformly distributed to the various cylinders by the manifold system. One cylinder will get a different charge from another, as can be easily proved by pressure gages. There are rarely two cylinders alike as to maximum pressures on a multi-cylinder engine using wet mixtures. Drying of the mixture will cure that fault, and also cure the carbonization that comes from the vaporization of the liquid in the presence of the burning gas when it has been admitted to the cylinder in a liquid state.

The third factor of the mixture question is homogeneity. However accurately the mixture may be adjusted as to fuel and air ratio, however carefully the mixture may be distributed, cylinder to cylinder, the fact remains that, in order to produce economical results the charge in any one cylinder must be uniform in every cubic inch of it. It is not sufficient that the right amount of air be in the cylinder even if the fuel is vaporized, when the later is all in one corner.

Following mixture quality, the next factor in efficiency is rate of flame propagation with reference to piston speed. It can be shown that the explosion line of the indicator card following compression must be maintained vertical for maximum efficiency. Now, the rate of propagation is the one factor that tends to hold it vertical. If the propagation rate is high enough for a given piston speed, so that the explosion line is vertical, the efficiency will be high. But should the piston speed exceed a certain value, then the explosion line will begin to lean toward the expansion line, until by and by it becomes hozizontal and merges into the expansion line, with a consequent large loss of work area and low efficiency or high fuel consumption. Therefore, there is for every given mixture a limiting piston speed that cannot be exceeded without destroying efficiency, and we are now approaching that speed in aeroplane engines.

The next related factors are mean effective pressure and speed. These are the prime factors for the output of a cylinder.

If the mean effective pressure were constant, then the horsepower with reference to the speed would follow a straight line. The mean effective pressure is not constant as the speed varies, however. Therefore, plotting horsepower against speed gives a curve having the general form of concave downward and consisting of several separate portions, each worthy of study. There is usually a straight portion over a given speed range, during which the mean effective pressure is constant. For lower speeds the mean effective pressure is lower, and for higher speeds the mean effective pressure is again lower. From the point where, with increasing speed, the straight line becomes a concave-downward curve, the mean effective pressure is decreasing as speed increases, until at the point where the tangent to the curve becomes horizontal, the rate of increase of speed is exactly equal to the rate of decrease of mean effective pressure. At a little higher speed mean effective pressure decrease faster than speed increases, and finally the curve drops down toward zero power.

Volumetric Efficiency of Engine

So much for the facts. An analytical engineer cannot be content with those facts, however, but finds it necessary, if he is to apply a cure, to go behind the facts to ascertain the reasons. The first step in doing that is to determine the volumetric efficiency of the engine by measuring the air and fuel and comparing the total volume of mixture taken in with the piston displacement. If the volumetric efficiency be plotted against the speed, much light is thrown on the situation. In the first place, the volumetric efficiency falls off in the region of very low speed, where the mean effective pressure is low; it is constant over the region of constant mean effective pressure, where the horsepower-speed line is straight, and then at some high speed it again decreases. It is clear, therefore, that curvature of the horsepower-speed line is due to a corresponding variation of volumetric efficiency. It may be found, however, that at some high speed the horsepower-speed line falls before the volumetric efficiency. This calls attention to the fact that the falling off of mean effective pressure at high speeds may not be due primarily to volumetric efficiency but to other causes, and this starts a search for those causes.

The first of these causes is too slow a combustion, or too high a piston speed. That is to be corrected by adding an additional ignition source, or by moving the spark plug form a side wall to a center point. Igniting at more than one point or at a more central point will cure this defect, and again cause the dropping points of both horsepower-speed and volumetric efficiency-speed curves to lie on the same speed line.

Again, it will be found that a change in the valve setting changes this mean-effective-pressure curve at both ends, but every change in the valve setting also changes the mean effective pressure, and the volumetric efficiency is itself the direct measure of whether or not one has the best valve setting

Now, it is curious that most people have played with cams and adjusted them back and forward by guesses, and have never bothered about the air meter, which is the only positive means of arriving at best cam forms and valve timing for sustained mean effective pressure at high speeds.

Many more analyses along the above lines could be given, but enough has been said to call attention to this most important means of studying the problem of maximum power at high speed, not only revealing what is the matter but pointing out clearly the direction in which to correct the fault.

So much for efficiency and mean effective pressure, or efficiency and horsepower per cubic foot of cylinder. Those two factors bear directly on the fuel weight to be carried and the output per cubic foot of cylinder. What will be the weight of that cubic foot of cylinder? This has to be judged both by qualitative and quantitative analysis. It is impossible to give any quantitative analysis without long mathematical treatment, so I will undertake only the qualitative analysis.

The Weight Factor

The first point in qualitatively analyzing unit metal weight of the multi-cylinder engine is to recognize that the engine can be divided laterally by planes into sections of one cylinder each. The end sections are the same as each other, but are different from the intermediate sections. Therefore, to study qualitatively the relative weights of two typical constructions, the mind must be concentrated upon these sections, each one of which includes a cylinder, a piece of frame, a piece of shaft and the other parts that go with the section.

From this point of view, consider multiplication of cylinders in line vs. radially or circumferentially. It will appear that the weight of the cylinder, piston and connecting rod is just the same no matter how the cylinders are arranged, but the frame weight and shaft weight are reduced by any multiplication. It is clear also that, other things being equal, the lighter arrangement is circumferential rather than longitudinal multiplication.

Now, going back to the history of the situation, we find every conceivable combination has been tried, but these have finally crystallized to not more than two kinds, giving the V-type engine and the engine with cylinders in line.

Considering the effect of cylinder diameter upon unit metal weight, it will appear that from the unit-weight standpoint the cylinder diameter should be as large as possible, because the wall thickness of a cylinder is always greater than necessary for the stress for other structural reasons. A 1/16-in. cylinder of steel will not be stressed over, say, 10,000 lb. per sq. in. The cylinder could be made much thinner than this and still have a good working stress if there were not other structural objections to it. This being the case, the larger the cylinder for a cubic foot of displacement the less the unit metal weight in the wall, and the only limit to large diameter is good running.

Considering the stroke, as this is increased the metal in the cylinder piles up endwise, or axially, too fast with reference to volume, and therefore for minimum unit metal weight the shorter the stroke the better. In proportion, we are using, normally, shorter strokes in aeronautical motors than in automobile engines for that reason.

Again, as effecting the metal weight, we have the connecting-rod length. Clearly, the shorter the connecting-rod the shorter the frame, and therefore the more metal saved. The only objection to the shorter connecting rod is an excessive angularity, which introduces stresses requiring metal thickening in other places.

Multiple Cylinder Engines

The number of cylinders should be as large as possible up to the point where the weight of the connecting parts has to be increased. A two-

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cylinder engine has less than twice the weight per cubic foot of displacement than a single cylinder, for the reason that the number of end supports for the shaft, etc., is not increased. Similarly a three-cylinder has less than three times, a four-cylinder less than four times, and so on; and the weight per cubic foot of displacement gets less and less until a certain number of cylinders—somewhere about six—is reached where the shaft diameter and the weight of the frame must be increased so as to retain the necessary stiffness, whereupon the saving in weight by multiplication is neutralized. This appears to be about the limit of saving by line multiplication.

The metal weight per cubic foot of cylinder displacement has to be taken up along the lines indicated, extending the study to the form vs. weight of each individual member. It will appear, as one examines the forms of these individual members, that one form is clearly susceptible of less weight than another—even with the same working stresses or with equal factors of safety.

The first of these tudies should be undertaken with reference to cylinders. The first cylinders built were made of cast iron, with head, cylinder and jacket cast in one piece, and the valves being arranged in a side pocket—the ordinary T- or L-head construction. It is clear that the weight of the valve pocket is detrimental. The first step in any cylinder-weight reduction, then, is to take that pocket away, retaining the cast cylinder (on the assumption that we do not know how to make any other kind) and putting the valve in the head. This results in the valve-in-head construction, which is now practically universal, but which, strange to say, it took six or seven years to realize.

Jacket Wall

A similar instance of slow realization of facts exists with reference to the cast-iron jacket wall, which has no other function than to hold water. Cast iron for that purpose, especially in an aeroplane engine, is wasteful of material, so the next step is to get rid of the cast iron. When one stops to think how it is to be done, a structural difficulty becomes apparent, and therefore one must not too readily condemn the holding on to the cast-iron jacket. The difficulty is of course the necessity of providing openings for the intake or outlet from each valve, an igniter plug hole and at least two pipe connections for the jacket, and in an aeronautical engine under heavy stress there is some driving gear which requires fastenings. This naturally tends toward the use of a casting.

Suppose such a casting is used, with inlet and one exhaust valve each with a port leading out, and such valve seating in the head which turns down to form the cylinder; then the casting may be led around the top, forming the inclosure of the head jacket and joining the several outlets and coming down outside the cylinder. The cylinder-head jacket casting ends in the form of a skirt at about the level of the valve deck, and to this end a tube jacket can be added by any one of several possible fastenings. That is the next step; cast iron for the cylinders, head and head jacket in one-piece casting, but with sheet metal for the jacket over the cylindrical barrel. It is a logical step, but it took several years to reach it just the same.

Proceeding along the same line of weight reduction, the next step is to cut away this cast iron joining the ends of the ports and forming the wall of the head jacket, and substitute sheet metal welded to the ports by the oxygen welding system. Wherever there are connections to be made for attachment of gears, there must be some additional supports welded or brazed on. The cast-iron cylinder is still there, and with cast-iron ports.

Steel Cylinders

There is a fundamental objection to a cast-iron cylinder for aeronautical work, and it is a perfectly valid one. Cast-iron cylinders do not have to be very thick to be amply strong, so far as the gas-pressure stresses are concerned, but the fact remains that so long as they are cast iron, no one knows whether they are good cast iron inside or not, and the use of cast iron cut down to ⅛ in. in thickness incurs taking some chances. Hence attention is turned toward steel.

Drawn steel or forged steel is a reliable material and a logical selection, so designers have sought means of using it; but when one stops to think how to use a drawn-steel tube for a cylinder, and get the necessary attachments on it, one soon recognizes that the matter is not so easy as it looks. That is the reason the adoption of the steel cylinder was so long delayed.

There are now several schemes developed for steel cylinders. The first of these is a steel cylinder of a drawn tube formed without a head, screwed into a separate head carrying the ports and the head jacket cast in one piece. This is rather a satisfactory way of attaching a head, but it involves more than one difficulty. When such a screwed head is set up against the shoulder, it is not at all clear just where it is going to stop; and to secure the proper position one must either scrape the faces or shim them—neither of which is a nice job. A further objection is the considerable weight of the cast iron in a rather complicated casting, and also the inner wall of that cast iron is a stress wall, the stress of which must pass through the thread to the cylinder. There is no objection to using a casting if it is not stressed, but a casting under stress is not satisfactory and is to be retained only in the absence of something better.

Elimination of Castings

Complete elimination of castings has been tried by using all-steel and sheet metal welded together, but this did not prove satisfactory for a very interesting reason. A flat sheet-metal head on which the valves are seated will not remain flat, and a round valve seat will not stay round. Such sheet metal tends to warp out of shape, and with it the valves will not stay tight. However, the material does not break, which is something worthy of thought.

To eliminate the weld between the steel cylinder and head, another construction was developed. In this, a seamless drawn-steel shell with head just like a cartridge is used, and two holes are arranged in the head to seat the valves. It is evident that this is a structure which is sound against all kinds of stresses. It still has some of the difficulties of warping the seats, causing leakage of the valves; and when a valve leaks the amount of heat developed is tremendous. Once a valve starts to leak, it is only a question of a short time before it will be completely destroyed.

The particular construction of cylinder just described is rather difficult to attach to its jacket ports. It is interesting to note one case at least in which a satisfactory attachment has been worked out, and that is the Hispano-Suiza engine, now used on the European war front, and now also being built in this country. In this particular engine the entire outside of the cylinder is threaded, and the cylinders are screwed into an aluminum casting which is double-walled just like the cast-iron block casting of an automobile engine. The thread performs the double purpose of holding the cylinder in place and bringing its head up against the aluminum cast head which carries the ports, and also acting as a thermal bridge between the metal of the cylinder and the metal of the aluminum casting which carries the jacket water. Without the latter there would be poor thermal contact and overheating of the cylinder. While this construction is not entirely satisfactory, it is nevertheless very interesting and suggestive. It immediately calls attention to the fact that a water jacket may be made of an aluminum casting and the ports formed just as easily as in iron, the steel interior carrying the stress due to the interior gas pressures.

It is, however, quite feasible to get rid of the double aluminum wall down along the cylinder barrel into which this steel cylinder is placed and which carries the ports above, by leaving out its interior wall and retaining the outside, or even by stopping the wall just below the head as a skirt to take a short thin tube which may itself be of aluminum, ending at the bottom in a cast stuffing-box ring to act as a joint against the steel cylinder. That, so far as I know, represents the last word in this direction, the steel cylinder head being bolted up to the aluminum head-port casting at the valve-seat bases, and not just pressed up against it by a remote thread.

Cylinder Head Construction

Finally, there is to be noted the one-piece steel-forging construction for cylinder, cylinder-head, ports and ignition holes, surrounded by a sheet-metal welded jacket, a very satisfactory though expensive construction.

These heads are themselves a subject of considerable study. We have first a plain head in which the valve inside diameter is half the cylinder less the width of seat, and half the bridge between the valves. Both valves have stems pointing upward and parallel. The plain cylinder, then, which can be made of a plain seamless-drawn steel cartridge, and which is so desirable structurally, limits valve diameter, and this is a factor against it. Valve diameter is a strong influence in volumetric efficiency and weight of charge, controlling, as it does, flow-resistance conditions. Naturally, designers must get the volumetric efficiency as high as possible by keeping flow resistance as low as possible. Therefore, the tendency is to go toward larger valves than is possible with the previous arrangement.

One variation in form for this purpose is the flat bulged head where the valve diameter is larger than before by the amount of the bulge. The flat bulged head is a very desirable thing for larger volumetric efficiency and higher mean effective pressure, but offers some difficulty in manufacture when one is making a one-piece seamless-drawn steel job, but not a serious difficulty.

Another suggestion for getting the same result is to bulge this head upward in the form of two flats and put the valves on the two inclines. It is perfectly clear that a very large increase in diameter can be secured in this way. The valve stems in this case are not parallel but diverge at any angle, and the limit is reached when the angle is 180 deg., in which case they are horizontal.

Block Arrangement of Cylinders

The question of block arrangement of cylinders and their jackets vs. separate units deserves some attention. In some cases each cylinder with its jacket and head is entirely separate. In other cases the jackets are cast or welded in a block form, around more than one cylinder—sometimes two and sometimes four, and in some cases six. It is clear that the more cylinders included in the jacket block, the less will be the weight of the jacket, because the length of the tangent to two jacket circles is less than a half circumference. But there are objections to the block, and in some cases it may not pay to use it.

In a case in point, a cast-aluminum block jacket was set down over four steel cylinders which were bolted to the frame by their usual flanges and studs. These cylinders gave trouble on the outer flanges, the end studs breaking off or pulling out. The trouble was caused by the crankcase running hot, expanding, and the aluminum block cylinder casting running cool, because it was water-jacketed, not expanding. The cylinders being bent inward tore the stud ends right out.

Another point: the steel cylinder is naturally flexible, and it belongs—in fact, the entire motor belongs—to that class of structures which should properly be termed flexible, exactly similar to bridge structures.

These flexible motors weave just as the engine of a steamship weaves. To attempt to hold one against springing is to attempt what is practically impossible. The cylinders of aeroplane engines should all be perfectly free to go as they will, and not be held on the top in any way. All the block arrangements of cylinders of the sort just described are therefore objectionable. Steel cylinders have a natural spring and give to them, and if let alone they will serve well; but attempting to secure them may result in serious distortions, or in highly localized excess stresses.

Valve Gear Construction

It was my intention to elaborate on the different arrangements of valves and valve gears, but that would take up too much space, so I will first just draw attention to some typical gears. One of these has a rocker arm overhead, worked by a push rod from a camshaft in the crankcase. In some cases this one push rod works two valves. When the valve stems are in line with the rocker fulcrum placed in the middle, each may be worked alternately. This push-and-pull may be secured by a single cam having a plus and a minus face, or by two opposed plus face cams having a plus face with a fork—the second form being far preferable. That particular form of driving the overhead valve by a rocker from a crankcase camshaft is now regarded as old-fashioned, but here is one case where there is something in favor of the old-fashioned. The new fashion is the overhead camshaft, where one camshaft, running along over a whole line of valve stems, will work them directly, or, being offset a little bit, may work through rockers, all stems being equidistant from the camshaft. When the two valves for one cylinder are on a line at right angles to the shaft, the camshaft may be placed between them, working with double rockers.

The objection to the overhead camshaft is twofold. In the first place, a camshaft mounted on separate cylinder heads exert a restraint against their free movement. The variance of that camshaft will necessarily cause a stress, and the camshaft will be bent, and it is only a question of time when something will fail—either by wear or breakage. Again, the cam is very close to the valve stem, and the adjustment of timing is very delicate. It is difficult to adjust a valve directly driven by a cam so that it will be accurately timed, and stay timed, when a difference of 0.01 in. means several degrees.

The location of the camshaft down in the crankcase, with rods coming up to the rocker arms or levers, allows each cylinder to be entirely free, and does not interfere with its turning in any direction whatever. Also it permits the use of longer levers and a far more accurate adjustment of the timing clearances between the cam and the stem on the long reach rod; but such a reach rod should be either a tension rod or should not be used at all. A push rod in a place like that seems to be fundamentally wrong. Here is a case of a long column of thickness of about half one's little finger, which is, in many cases, opening a valve—an exhaust valve—against an internal pressure of 40 lb. per sq. in., and a diameter of 2 in. or more, and, in addition, overcoming all the inertia of the gear and valve at perhaps 2500 r.p.m. That is not a proper function for a long column, but is a perfectly proper function for a tension rod, or steel wire, and why no one has put a steel wire between the valve stem and camshaft, which will allow the whole structure to go the way it wants to, instead of abandoning the crankcase camshaft, is more than I can see. Of course, the block construction is more favorable to the overhead camshaft but it has not all the advantages.

GLUE FOR USE ON AEROPLANES

By PERCY A. HOUSEMAN[1]

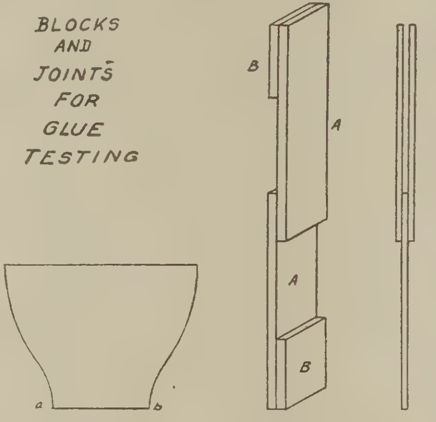
There are many parts of an aeroplane that require the use of an adhesive material. Of these may be mentioned "airscrews" (the collective name for propellers and tractors), hollow spars, booms, ribs, ply-wood, etc. For some of the small parts, such as the ribs, which are subsequently covered by "doped" fabric, it is not necessary to use the best quality of glue. For other parts, however, it is of vital importance that only the strongest glue be used. This applies particularly to airscrews, which rotate at a very high speed. Airscrews are built up in laminae of walnut or mahogany, usually 7 in number, and each 1-inch thick. It is usual to glue two laminae together, and allow them to remain in clamps for a period of from 6 to 24 hours before gluing on the next lamina. The finished airscrew is shaped out after the total number of layers have been glued together and have been allowed to set. The glue is applied hot, and usually by at least two workmen, in order to cover the surface as quickly as possible. The temperature of the gluing room is kept above 70 degrees Fahrenheit. It would, of course, be an economy to glue at one operation all of the laminae of an airscrew, but this is not possible when a cake glue is used, on account of the rapidity with which the hot solution sets. Attempts have been made to overcome this difficulty by the use of "liquid" glues, but these have usually proved unsatisfactory. One French liquid glue contained some hygroscopic material, and failed to set in 14 days. "Liquid" glues should be used only on work in which great strength under widely varying conditions of temperature and humidity is not of prime importance. Bone glue should never be used on aircraft work. The best results are obtained from skin or hid glues.

In working out a method for the examination of glue some attention was given to such chemical and physical tests as moisture ash, nitrogen, strength of jelly, viscosity, percentage precipitable by alcohol (Stelling's test),[2] etc., but while the information furnished by these tests was of interest, it was not found possible to correlate definitely the results obtained, with the value of the glue for aeroplane work.

A method was therefore developed to test the strength of a glued joint under various conditions. Experiments were made with blocks of biscuit-ware, as recommended by Rideal in his book on "Glue and Glue Testing." Messrs. Doulton, of London, kindly made the necessary blocks, which had a bas (*ab*) 1-inch square, similar in design to that shown in Fig. I.

Two such blocks were glued together under various conditions of strength of glue solution, temperature, method of application, pressure of clamping, etc. The blocks were pulled apart in a cement testing machine with automatic application of the load, but as uniform results could not be obtained, the stone blocks were abandoned. More uniform results were obtained with wood, which also has the advantage of giving results more nearly comparable with those obtained under actual service conditions. Pieces of carefully selected straight-grained walnut were used, and from them a number of different types of joints were prepared, and used to illustrate different kinds of stresses. The type of joint finally adopted is that shown in Fig. II. This joint gives by no means a true shear, as was easily seen by examining under polarized light a celluloid model made to scale. A stress more nearly approaching pure shear would probably be obtained with a joint like that shown in Fig. III, made up from pieces 9 in. × 2 in. × ¼ in., but for the purpose of obtaining comparative results, that shown in Fig. II answers well and has the advantage of simplicity.

The wood is exposed for 24 hours to a temperature of 35 degrees C. before making the joint. The test pieces (*A*) are 9 in. × 2 in. × ⅜ in. These were roughened by a toothed plane as it was found that a roughened surface is better than a smooth one. The distance pieces (*B*) are 3 in. × 2 in. × ⅜ in. The area of the glued surface of the joint to be pulled apart is 4 sq. in. To prepare the glue, it is broken into small pieces and is soaked over night in the requisite amount of water. For the gelatine types of glue, 1 part by weight of glue 2 parts by weight of water gives a desirable concentration, while for "Scotch" glues 1 part of glue to 1.25 parts of water gives the best results. For other types of glue the water required usually falls within these limits. The soaked glue is dissolved by warming to 60 degrees C., and the solution is applied at that temperature. The joints are clamped under moderate pressure for 48 hours, and are tested after a further 24 hours. For each sample of glue, the following three tests, each in duplicate, are carried out on the joints prepared as described above.



BLOCKS AND JOINTS FOR GLUE TESTING

FIG·I FIG·II FIG·III

(1) REGULAR TEST—The joints are pulled apart in a Buckton and Wicksteed or in a Riehlé (Philadelphia) Testing Machine and the breaking strain per sq. in. of glued surface is recorded. The experimental variation is less than ± 10 per cent, most of which may be ascribed to unavoidable variations in the wood.

(2) HEAT TEST—The joints are subjected to dry heat in an electrically heated oven for 2 days at 45 degrees C., and then pulled apart, and the breaking strain recorded.

(3) IMMERSION TEST—The joints are completely immersed in water at 20 degrees C. for 12 hours, and are then pulled apart, and the breaking strain recorded.

Tests (2) and (3) are intended to throw light on the behavior of an airscrew under the extreme conditions of a tropical climate and high humidity. Tests were also made with moist heat, and on immersion followed by dry heat, but were discontinued. The last named test was found to be too drastic, all glues giving very low results.

The whole procedure outlined above is an arbitrary one, and for this reason it is necessary rigidly to standardize and adhere to the technique of the method, in order to obtain comparable results. When the break occurs in the wood (as frequently happens in the regular test, one can, of course, only say that the glue is stronger than the wood, and record the figure at which the wood breaks.

TABLE I—INFLUENCE OF ADDITION OF PHENOL OR CONCENTRATED AMMONIA TO GLUE ON STRENGTH OF GLUED JOINT

GLUE TESTS	REGULAR		HEAT		IMMERSION	
Gelatin A	644	627	459	...	504	...
Gelatin A + 5% Phenol	532*	616	476*	627	621	...
Gelatin A + 10% Phenol	677*	845	369	487	560	660
"Propeller" Glue	464	...	470	464	540	504
"Propeller" Glus + 5% Phenol	526	593	395*	506	553	560
"Propeller" Glue + 10% Phenol	610	632	315	429	560	565
"Scotch" Glue	548	571	448	470	448	470
"Scotch" Glue + 5% Phenol	688*	723	425	425	532	548
"Scotch" Glue + 10% Phenol	694	694	414	453	436	476
Gelatin A	627	644	459	565	504	549
Gelatin A + 2% Ammonia	610	655	616	688	800	875
"Propeller" Glue	464	...	464	470	540	504
"Propeller" Glue + 2% Ammonia	520	532	580	609	648	783

The figures represent breaking strain in lbs. per sq. in. of glued surface of the standardized joint. Breaks in the wood are indicated thus*

Addition of phenol to the glue improves the regular test. The influence on heat tests and one immersion tests is not marked, but the tendency is to raise them slightly. The addition of 5 per cent phenol to a 1 : 2 gelatine solution, depressed the setting point of that solution from about 26 to 18 degrees C., while 10 per cent phenal caused the solution to be still viscous at 5 degrees C. The addition of 5 per cent phenol to glue solutions to be used on aeroplane work is, therefore, to be recommended, both because of its tendency to increase the strength of the joint, and also on account of its action in depressing the setting point.

Ammonia causes the glue to set more rapidly. It was found to have the unexpected effect of raising the figures for heat and immersion tests, while leaving regular tests little affected.

The Germans apear to have used a casein glue on some of their aircraft. An analysis of a Swiss glue of this type showed its composition to be about 66 per cent casein and 23 per cent mineral matter. The latter was composed of soda silica, lime and alumina. About 1 per cent of petroleum was present in the powder. This casein glue is prepared for use by rubbing up with cold water. It requires about 3 days for the joint to set, but has the advantage that all the laminae of an airscrew can be glued together at once.

The following test figures were obtained on joints made with the Swiss casein glue:

Regular		Dry Heat		Moist Heat		Immersion	
551	655	526	661	448	465	672	862

The immersion test is particularly high.

Casein glues are very generally used for cementing together the "veneers" on ply-wood which finds extended use on the fuselage and other parts of the aeroplane. One English firm uses a mixture of casein, lime, and blood, which yields a cement very resistant to water. A three-ply board made with such a cement will withstand an immersion test in water at 50 degrees C. for 12 hours without any separation of the plies, though the strength of this cement on a "regular" test is inferior to that of a hide glue.

Another firm of ply-wood manufacturers uses lime and casein only, in the proportion approximately of 4 parts by weight of lime to 7 parts by weight of casein. Casein and borax form a good mixture, but are, of course, more expensive than casein and lime. Casein glues cannot be kept more than a few hours after mixing with water, so that a batch when mixed must be completely used, or the residue wasted.

When a new glue is intended for use on airscrews, the tests described above should be supplemented by a practical test of spinning a trial airscrew made with the new glue.

HIGHLAND PARK, LLANERCH, PA.

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[1] Formerly Chief Examiner, Aeronautical Inspection Department Laboratories, London, England.

[2] *Chem.-Ztg.*, 20, 461.

ON AEROPLANE HANGAR DOORS

THE efficiency of an aero hangar largely depends upon its adaptability to practical uses, and perhaps the most important point for consideration in the construction and arrangement of such a building is the exit. The span of the modern aeroplane has developed to such proportions as to demand an opening, clear of any form of obstruction, wider than heretofore was considered possible, and the provision of such an opening immediately created the problem of how to seal conveniently and at the same time effectively this opening; the idea of sliding doors was at once seized upon, and from that time onwards those in control of, or we may say in possession of, aerodromes have been saddled by an ever-recurring trouble.

If it is permissible to criticize the aircraft manufacturer—for he it is who builds to house his products—we would respectfully remind him of the fable about clockmakers, who are supposed to be notoriously lax in the matter of their own clocks, and I think the average aerodrome proprietor is much the same in the matter of his buildings, and certainly so in regard to any "sliding gear" on the same. To proceed in the same strain, it is wonderful that the average man who essays to construct such an intricate and delicate piece of mechanism as an aeroplane usually considers anything with four walls and a roof good enough to house the results of his labors, and if he can, to quote a gentleman somewhat interested in aeronautics, "convert a dwelling house into an aircraft factory" the happier he is.

Now, if this problem of sliding gear were attacked with a little more relaxation of the purse strings there would, no doubt, be found a solution which, even if costly at first, could certainly be modified in time and so brought to that happy state known as a "good commercial line." There are many forms of sliding gear, but one fundamental principle inseparable from all, and that the bearing at the top and at the bottom. It is essential, if satisfaction is to follow, that the greatest care and consideration should be given to these two points—the former with a view to the enormous lateral stress which the same is to bear, and the latter with a view to the foundations which are in all probability going to take the whole of the weight of the doors. It is not always sufficient to provide a concrete bed at this point and rely upon that alone to withstand the wear and tear. A good scheme is to reinforce this bed with light tee iron, which will help to distribute the load, a very valuable performance in all cases.

Another point distinctly worthy of consideration is attention to the condition of all forms of tracks and runner. Some of the attention so generously lavished upon the aero engine might profitably be diverted into this channel, the cause of a great deal of annoyance thereby being eliminated. Further, it is not sufficient to pour oil on the troubled waters of the sliding door, but go outside and consider what sort of approach you have to your building. If it be gravel, ashes, or other loose and easily transferable substance, have it removed and lay in its stead a good impervious paving. However rough and solid this may be it will be a welcome change from that obstruction which always seems to creep in front of the runner and impede progress.

As to the particular construction of a sliding door and as to whether it should be of one material or another gives food for much thought. From the point of view of depreciation one would be inclined to favor one of metal frame construction, which has also the advantage of being lighter than one framed entirely in timber, but it is, perhaps, simpler to make a weather-tight job with the latter rather than the former, particularly if a little generosity is displayed in the matter of "eaves" in connection with the roof and the head of the door be kept well under the same. But this does not, of course, affect the bottom, or "sill," and it is at this point that the wet driving across the open aerodrome will penetrate and cause trouble, if not discomfort. A good plan to obviate this would be to raise the bottom track slightly on a bevel edge base and also provide a weather-board running down as near the base as practicable and arranged in such a way as not to interfere with the superimposed leaves of the composite door when opened.

It must, however, be admitted that this last preventive measure is not so readily applicable to the door of metal construction, and it will undoubtedly be found in practice that the thorough weatherproof job is more readily obtainable by the use of the "wood framed door," and the question of weight must be dealt with in conjunction with the same.

In these days the man who built a theater and provided a fireproof curtain "To be lowered once during every performance" by manual labor would be considered a fool, yet one may see daily at almost any "drome" vigorous persons bending their backs against the unwilling door. Surely it would be possible by the application of a simple system of gears and the installation of a small automatically controlled dynamo to obviate all this trouble, as after all the job in hand is to "get the bus out" and not waste time over the process.

I will not attempt to deal with this suggestion in detail, but will simply give it as such and perhaps it may be the means of starting some fertile mind to work to the great profit of generations of aero habitués.

To return to the question of the actual gear or mechanism which shall be used—it would be well to deal with the question from its commencement, so to speak, and consider the track. The next consideration would appear to be the enormous weight to be carried. Consider the usual goods truck, and remember how such a truck once started will roll: and after all, what is it that gives the truck such apparent freedom? I interpret it as being lack of resistance. Again, it is recognized that this same truck can travel at a great speed upon the same track without fear of leaving it; it may, therefore, be considered fair to assume that a track similar to the ordinary railway metal would, with the elimination of the unessential strength, prove satisfactory, particularly if the running plane is level and is assisted in remaining so by the reinforcement of the bed as previously suggested. Having thus briefly dealt with the bottom bearing, consideration may be given to the top bearing. This, as has been previously said, is subject to a very different stress and its function is only that of keeping the door in place. Bearing in mind the lateral stress set up by wind pressure alone upon a beam with a bearing of anything over 75 feet between its abutments, it becomes not so much a point of the question of form of track or runner, but more as to how this beam may be kept, to use a theoretical term, in stable equilibrium. It cannot be "trussed" from the bottom and would certainly be so from the top, therefore the addition of side trussing by means of short posts and tie rods would greatly assist in keeping the running ways in alignment, an all-important factor in the efficiency of the same.

It is to be hoped that the foregoing may be considered purely in the light of suggestions, and in view of the numerous practical and hopelessly unpractical forms of track in use today it is felt that if the result of these few words on the subject is to turn ingenuity on to the job and relegate to the "far West" or further some of the appalling mixtures of craft workmanship which are daily being used and made, oftentimes to the sorrow of the manufacturer, to say nothing of a chance individual whose duty it may be to "approve" the same as satisfactory, then time and ink will not have been wasted, and we as a nation may be able to reckon among our achievements "during the war" the production of the all-satisfying aero hangar door.

L. M.

THE "AVRO" PATENT BARRELLESS TURNBUCKLES

This turnbuckle, patented and produced by Messrs. A. V. Roe & Co., Ltd., and sold by the Aircraft Supplies Co., is at the present time being manufactured in two sizes.

It has already been approved by the Aeronautical Inspection Department for use for internal bracing in place of other strainers or turnbuckles, where the strength is not less than that required. As will be seen from the table, two strengths of turnbuckles are at present being made, Marks C and D, with a breaking load of 1,216 lbs., and Marks E and F, which fail at 1,950 lbs.

The supplies at the present time of Admiralty, A.G.S., and Binet types of turnbuckles are, as manufacturers know, not nearly equal to the demand, while considerable difficulty is being experienced at the present time particularly in regard to supplies of the R.A.F. turnbuckles, and more especially perhaps A.G.S. 140. It may be mentioned that the Avro Barrelless Turnbuckle comes out at one-third the price of the Admiralty and R.A.F. types, and is almost equivalent to the price of the Binet type strainers.

A number of novel and ingenious features are incorporated in the Avro Turnbuckle, the following being particularly worthy of note:

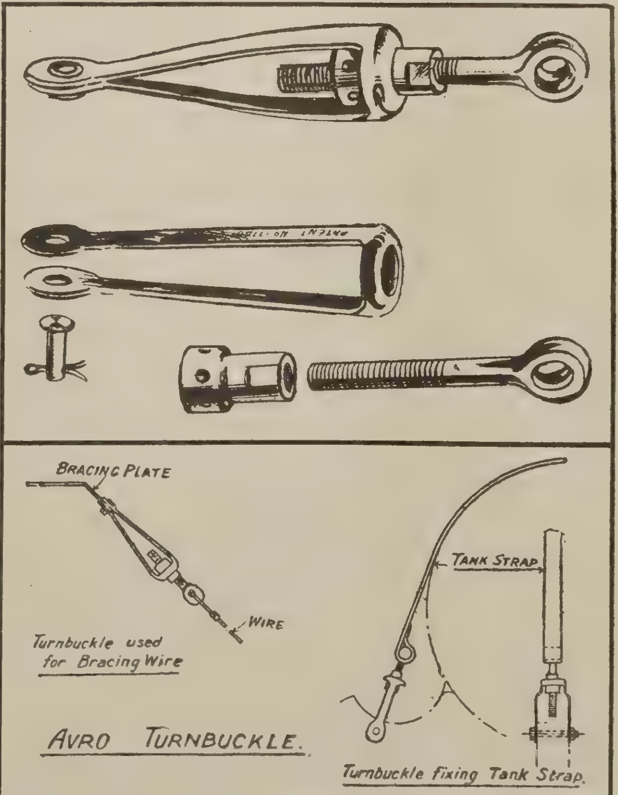
There is only one threaded shank and no internal threaded barrel. Hence, this turnbuckle can be manufactured in approximately half the time of the standard type.

No Delta metal and no steel bar to R.A.F. specification 1 D. are employed in its construction, and since these materials are both very difficult to obtain at the present time, again the manufacture of this turnbuckle is facilitated, while the elimination of the materials mentioned enables considerable reduction in the cost.

All eye-end bodies are ferruled as shown, while those of the forked end type are supplied complete with pins and split pins, ready for direct attachment to the bracing lugs.

In operation this turnbuckle is extremely simple. Adjustment is effected by rotating the nut, which is provided with small flats to take an adjustable spanner or key. A special Avro key is supplied free of charge with every consignment of turnbuckles. Locking is effected by a locking wire being passed through two of the small holes in the nut and around one limb of the body stamping with which the two free ends are twisted together. If desired the wire may be led up through the eye of the bolt, but in practice this has not been found essential.

The Avro barrelless turnbuckle is the lightest turnbuckle extant, yet while fulfilling the ordinary functions is applicable to many special circumstances. By reason of the body being in the form of a stamping, it may be distorted in numerous ways to suit special purposes, and can be applied for the fixing of the tank strap to a box form body stiffener. In this case a special "T" bolt takes the place of the eyebolt, while it should be noted that a special long shank bolt can be supplied to adapt these turnbuckles for the adjustment of control cables.


BRACING PLATE
TANK STRAP
WIRE
Turnbuckle used for Bracing Wire
AVRO TURNBUCKLE.
Turnbuckle Fixing Tank Strap.

Above, one of the double-eye Avro turnbuckles complete, and below, one of the fork and eye turnbuckles dissembled. Below, two special application of the turnbuckle

FOREIGN NEWS

FRANCE

During the week beginning June 3rd, the American Aviation Corps with the French Army was exceedingly active, each man averaging two fights a day. Every pilot in the squadron, not on the sick list has been engaged in at least one fight.

Most of the encounters have been decidedly victorious and three enemy machines are believed to have been brought down. The German machines have been painted recently in imitation of the Allied aeroplanes, and it is reported that one of the American pilots hovered about a German machine for about five minutes before he discovered it was an enemy plane.

Willis Haviland, one of the Americans, who has been in the hospital with blood-poisoning has returned to the squadron, and with C. C. Johnson of St. Louis has been promoted to an adjutancy, while Kenneth Marr and William Dugan have been made Sergeants.

It is reported that some of the American aviators are still engaged in dropping President Wilson's war message over the German lines. It is possible, however, that the Germans may have adopted a ruling like that they imposed in Belgium, namely that no one, on pain of imprisonment is to pick up any pamphlet dropped by an Allied aviator.

F. D. Benham, of the Staff of the *N. Y. World* has given up his work and has sailed for France to join the Lafayette Escadrille.

Ten years ago he was a schoolboy athlete in Brooklyn, playing on the football, baseball and basketball teams of Poly Prep. When he went into business he became treasurer of the Optigraph Film Corporation.

For the first three months in France Benham will be in the American Ambulance Service, a preliminary required of all men joining the Lafayette Escadrille. He is a nephew of Gen. Henry D. Benham, U. S. A., who was in the Civil War.

To the annual dinner of the Harvard Club of Paris on the evening of June 9, which brought together prominent representatives of France and prominent Americans, was given a military atmosphere, which was imparted by the khaki uniforms of the Harvard members of the Lafayette Flying Corps and Harvard volunteers in the American Ambulance Service. The dining hall was decorated with the Stars and Stripes and the French Tricolor.

June 9.—Naval hydroaeroplanes stationed at Boulogne have made several attacks with bombs on submarines recently.

Boulogne is on the French coast near the eastern end of the English Channel. It is one of the principal ports for traffic between England and France. Extraordinary precautions have been taken to keep submarines from these waters.

GERMANY

A dispatch from Krefeld, Rhenish Prussia, on June 7th, said that Lieutenant Schaefer, the German aviator who recently was credited with bringing down his thirtieth enemy aeroplane, has been killed in leading his squadron in battle with British machines.

The death notices in the German papers indicate what a terrible toll the western battle is taking among German aviators. Scarcely an issue of the Berlin, Hamburg, or other papers which circulate among officers appears without at least two or three and often eight or ten notices of deaths in the Flying Corps.

Occasionally there is a noteworthy one, like the announcement of the death of Lieutenant Schaefer, who was mentioned in dispatches for bringing down his thirtieth enemy aeroplane. Lieutenant Schaefer gained distinction in the "Traveling Circus" of Captain von Richthofen and was lately given command of a new fighting squadron on the Flanders front.

Death notices of submarine officers are as rare as those of flyers are frequent. For several weeks none has been noticed in the Berlin and Hamburg papers, and it is possible that the Admiralty has prohibited their publication.

Emperor William was with Field Marshal von Hindenburg, Prince Eitel Friedrich and other members of the German Emperor's staff inside the St. Peter's station at Ghent, Belgium, when it was bombarded by Entente airmen last week.

This is on the authority of a dispatch to the Exchange Telegraph Company from a Dutch frontier correspondent.

The Emperor's party was unhurt, but three army officers nearby were killed.

In Flanders on Friday, June 8, the Allies lost ten aeroplanes and Saturday six in aerial battles and as a result of German anti-aircraft fire. A few days ago Sergeant-Major Mueller shot down his fourteenth opponent in an aerial encounter.

GREAT BRITAIN

One June 5th, the Germans made another raid on the East Coast of England, sixteen aeroplanes participating. There is every reason to suppose that they contemplated reaching London itself, but that the effective anti-aircraft preparations foiled them in their primary object, so that they could get no nearer than the Thames Estuary. The Official Bulletin issued by Great Britain's War Office is as follows:

"An aeroplane raid this evening was carried out by sixteen aeroplanes. They crossed the Essex Coast at about 6.15 and dropped some bombs in the county and on small towns in Essex, and then proceeded, probably to attack the naval establishments in Medway.

"A considerable number of bombs were dropped and a certain amount of damage was done to house property, but the damage done to military and naval establishments was practically negligible. The raiding aeroplanes were engaged by gun fire and pursued by aircraft. After having lost two craft they made off seaward."

An official report issued the following day states that the raid was of bigger proportions than was thought at first, and that twelve people had been killed and thirty-six injured. The later report says that ten British aviators rose to give combat to the sixteen German raiders, and that in their escape eight German machines were brought down.

A series of photographic plates of the bombardment of Ostend which have arrived in London afford a remarkable example of the development of photographic observation and record by aeroplanes. They show undeniably that the British bombardment of Ostend last Tuesday (June 5th), was the most successful thing of its kind yet accomplished, insuring the crippling of Ostend as a German base for weeks, if not permanently.

There are several series of these Ostend plates in the photographic record room of the Admiralty Building, and they must be seen together to understand the result of Tuesday night's work. The first group of plates was taken before the bombardment and shows the town in panoramic squares. With a small reading glass it is easy even for an untrained eye to distinguish the essential features of docks, factories and harbor works in their normal condition and to trace railroad tracks, streets and storeyards.

The section around the docks, embracing that part of the town which is of military importance, is a mass of low sheds with broad, flat roofs and is distinct from the residence section, which stretches out in a long flat vista of little roofs and tiny gardens. A second group of plates shows Ostend after the bombardment. At first sight the pictures are disappoining. Taken from aeroplanes a mile or more above the town the pictures show no great general devastation. The work of a hundred or two heavy projectiles, such as used by the British monitors, does not impress itself heavily on a landscape like the work of an earthquake. There are no large general changes in the outline of the town, but when one gets down to careful comparisons with the pictures taken before the bombardment there are striking changes here and there which grow in importance as they are studied under a magnifying glass.

First of all there is the harbor. One is immediately struck by a slight change in the appearance of the great lock gates, on which all the activity of the harbor depends. These gates are one hundred feet long and twenty feet high, and they seem somehow to have lost a little of their rectilinear character overnight. The magnifying glass reveals some of the reasons for this change. The breaking down of the locks prevents the retention of water in the basin and the canals which feed it, incapacitating the entire port machinery. Equally effective in crippling the harbor is a hit on the operating machinery, jamming the locks so that ingress or egress is impossible until elaborate repairs are made.

The plates taken the day before the bombardment show a number of ships at anchor in the harbor or tied up in the inner basin. In the succeeding plates some of the ships have disappeared and others are apparently half submerged. The long wharf looks like a caricature of its former self and two or three buildings in the dock yards have suffered badly.

The pictures confirm the statement in the official report that more than half of the buildings in the factory section of the town have either been destroyed or badly damaged.

On the evening of June 6th, British naval aeroplanes attacked two enemy machines three miles northeast of Dixmude. Both enemy machines went down completely out of control. Another naval pilot attacked and shot down out of control an enemy aircraft five miles northeast of Dixmude.

During the battle British aircraft on June 9th co-operated very successfully with both the infantry and artillery, performing valuable services. In addition to a large number of successful air raids which were carried out, during which the enemy's airdromes, balloons, trains, billets, depots and troops were attacked with bombs and machine guns, enemy aircraft were prevented from participating in the battle.

In the course of bombing raids carried out by British aeroplanes against the enemy's railway stations Thursday night (June 7), a large accumulation of rolling stock containing ammunition was detonated by a big bomb. Fires and explosions continued until dawn.

June 9th three German aeroplanes were brought down in the air fighting and four others were driven down out of control. Six British aeroplanes are missing. Two of these were lost as the result of a collision during a fight with a number of hostile machines over the enemy's lines.

Colonel Winston Churchill is reported to have accepted the chairmanship of the British Air Board, succeeding Viscount Cowdrey, who recently resigned his portfolio.

The announcement of the appointment of Colonel Churchill as chairman of the British Air Board appears from a later report to have been premature, if not incorrect.

The announcement is denied by the *Post,* which says that Lord Cowdrey has not resigned. The *Times* also denies the Churchill appointment, but adds that it is likely to come in the near future.

ITALY

Details of a spectacular aerial battle over Trieste on June 7, in which Italian flyers forced Austrian battleplanes to descend precipitately in the crowded streets, were made public.

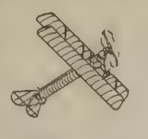
The Italian machines were seaplanes, out on a reconnoitering expedition. They were unmolested until they arrived over Trieste. Crowds in the streets saw Austrian planes rise to meet the supposed attack and then scattered as the Austrians beat a hasty descent.

The Italian flyers reported that many of those in the crowd cheered the Italian success and were promptly arrested by the Austrian authorities.

Rome, June 9.—"I would rather die than be taken prisoner," said Gabriele d'Annunzio the other day to some fellow aviators.

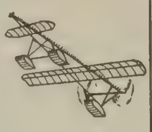
As an example of great heroism, d'Annunzio recounted the brave act of an Italian aviator who, when exploring over Val Sugana, met two enemy airships. He at once attacked them and had the good fortune to destroy one, but his observer was killed and his aeroplane was damaged in vital parts. He felt he could not alone continue the struggle. He gave no thought of saving his life by landing in the enemy's territory, but his only anxiety was not to leave his airship in the enemy's hand. He flew low through the thick fire of the quick-firing guns trying to reach the Italian lines, but, though shot mortally, he still had the strength and divine inspiration to dash his machine against the rocks of Rio Torre, where the hero, his dead companion, and the aeroplane were burned.

"But from the ruins of the wreck and the bones flew up victory intact. Mors victoria vitae (death is the victory of life,)" concluded the Italian poet, who in recent battles, has accomplished great acts of courage and has taken part in the now historic aerial raid over the enemy's lines.



MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City
PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
LONG ISLAND MODEL AERO CLUB
401 Grant Ave., Cypress Hills, L. I.
BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md.
NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

The Formation of Model Clubs

(*Continued from page* 332)

RULES FOR CONTEST HANDICAPS

13. At the discretion of the club there may be imposed a handicap for club events as follows: A contestant in order to win must exceed his last record with which he won a prize.

COMBINATION AND DURATION EVENTS

14. First, second and third records to count. Lowest number of points to win. For example:
A may have 1st in distance and 2nd in duration, 3 total points.
B may have 3rd in distance and 1st in duration, 4 total points.
C may have 2nd in distance and 3rd in duration, 5 total points.
Accordingly A wins.

R. O. G. CONTESTS

(Rising from the Ground)

15. Models to be set on the ground and allowed to start off without any effort on the part of the contestant. Models should rise from the ground before reaching a predetermined mark, no flight to be considered unless it does so. Contestant may start at any length back from the mark, but the distance is to be measured only from the mark.

EVENTS OPEN TO ALL

16. These events are open to all, with no handicaps to be imposed on either club members or others.

INTER-CLUB MODEL AEROPLANE TOURNAMENTS

(Prizes to be determined by contesting clubs)

The Tournament to consist of five events as follows:

Duration: Models launched from hand.
Distance: Models launched from hand.
Duration: Models launched from ground. R. O. G.
Distance: Models launched from ground. R. O. G.
Duration: Models launched from water. R. O. W.

Dates for inter-club contest should be arranged for at least three weeks prior to date of first contest, to allow ample time for the construction of special models and elimination trials.

In event of inclement weather, the contest to take place the week following, or at any time that may be determined by a committee appointed by the contesting clubs.

Each competing club must be represented by a team of three contestants and one non-competitor, who will act as judge in conjunction with the judges from the other clubs, and a manager selected by the judges who will supervise over the entire tournament and issues calls for meetings.

Meetings of the judges of the competing clubs should be held at some designated place, at which time dates and general details shall be arranged, and between events there should be a meeting called, for general discussion regarding the recent event, receive protests and suggestions and to announce officially the result of the contest.

The manager shall have control of the various events, assisted by the judges and they shall decide all disputes that may arise, and act as scorers and timers, as well.

Each flyer will be allowed but one model and shall be entitled to three official flights, but he shall be permitted to make any repairs or replace any broken parts. No contestant shall be privileged to fly a model not of his own construction. Each event shall close when all the contestants have made three official flights, or when three hours' time has elapsed.

(*To be continued*)

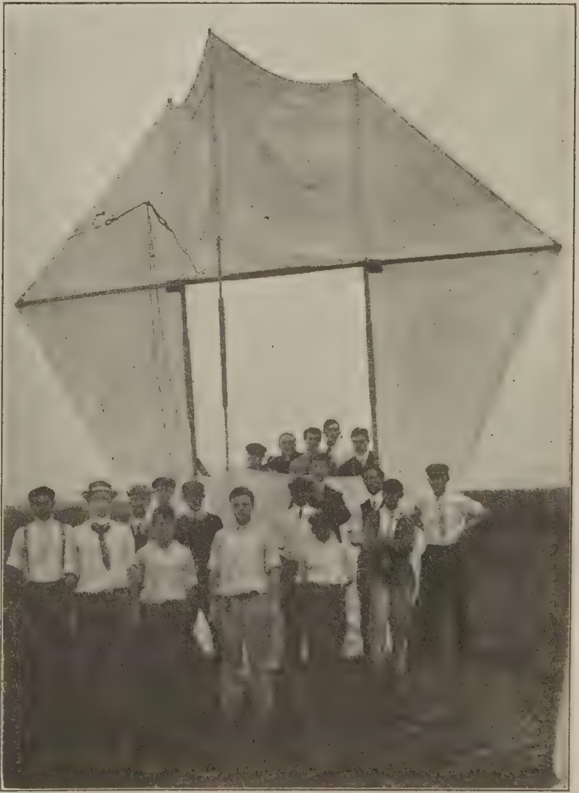
Detroit Model Flyers Attention

Mr. Leo Dixon, 278 W. Ferry street, Detroit, Michigan, formerly an active member of the Youngstown Model Aero Club, is anxious to establish a model aeroplane club in Detroit and wants to enlist every young man in Detroit who is interested in this branch of aeronautics. Get in touch with Mr. Dixon and help boost this new and interesting sport.

Man Carrying Kites

To make and fly an ordinary kite requires no little amount of skill but when it comes to handling kites that will lift men into the air a knowledge of kites is required that only comes after many years of practical effort coupled with ingenuity.

The "little" kite shown is only one of the many man carrying kites made by Sam Perkins. The kite is one of the 18-foot type and when it sails aloft every man shown in the photograph is needed to hold it from getting away. Mr. Perkins states that it is safer to use a tandem of smaller kites for, should one break away, there is very little danger of dropping; and he ought to know for he is one of the few men in this country who has practically made a life study of kites. The big kite shown is one by which Mr. Perkins has been lifted several hundred feet and on another occasion he was lifted to the height of 500 foot breaking the American record. According to him it is quite possible to go as high as 1500 feet with safety.



Mr. Samuel F. Perkins, second from left, with straw hat

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

(The following poem was given to us without a name, so it will have to remain nameless. It is intended to be sung to the music of "Keep the Camp-Fires Burning." If it happens that some of our readers are not familiar with the music of that grand old song, on receipt of five dollars to cover mailing, packing, etc., we will mail the music of "Keep the Camp-Fires Burning," free of charge, and will include the original words for good measure.)

We are coming from the office,
We are coming from the shop,
And our country finds us ready,
And we're never goin' ter stop
Till the seed is in the furrow
And the harvest in the bin,
And although our back is breaking
We are going in to win.

Keep the freight cars moving,
Our industry proving;
Turn the green sod upside down
While planting's good.
Start the hoe and shovel,
From mansion, house and hovel,
Make each patch of ground bring forth
Some kind of food.

Though the sea is full of U-boats,
And our ships are sinking fast,
We will build a fleet of transports
With Old Glory at the mast.
And we'll load 'em to the gunwale
With the best that we can raise,
And we'll man 'em with an army
And we'll win our Allies' praise.

Keep the transports sailing,
And the U-boats wailing,
Turn the Germans upside down
In the deep blue sea.
Feed our Allied Nations
Uncle Sam's War Rations,
Turn the tide of battle to
HUMANITY.

—A. P.

A Fitting Testimonial

Our readers will perhaps remember that a long time ago the Aeronitis Editor suggested that the United States Government needed thousands of aeroplanes. They now see the results of our suggestion—the recent sixty million dollar appropriation for aeronautics. Read the Aeronitis col. for the best and latest news.—(Advt.)

A Real German

We have heard so much about the examination that a prospective aviator must go through to get into the service that we are going to quote a few lines from the opera "Patience," just to show what a general had to know in those days. We hope that our future soldiers will be encouraged.

I am the very pattern of a modern major-gineral,
I've information ve-ge-ta-ble, animal and mineral;
I know the kings of England, and can quote the fights historical,
From Marathon to Waterloo, in order categorical.
I'm very well acquainted, too, with matters mathematical,
I understand equations, both the simple and quad-ra-ti-cal;
About bi-nomial theorem I'm teeming with a lot o' news,
With many cheerful facts about the square of the hypotenuse.

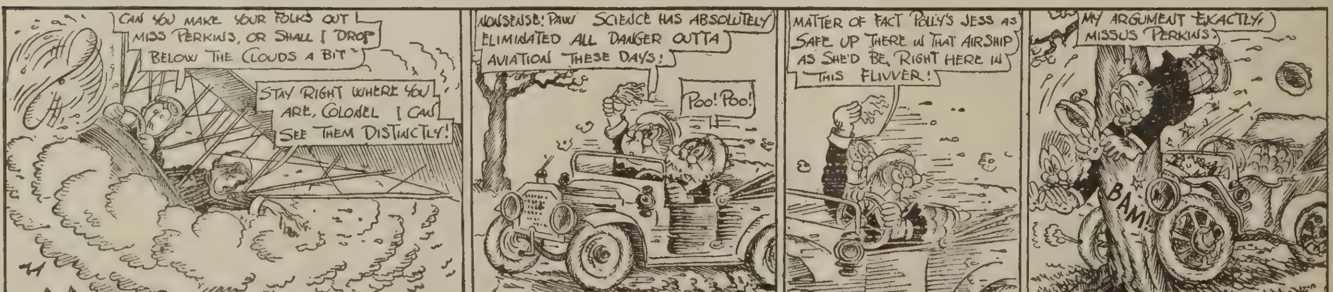
I know our mystic history, King Arthur's and Sir Caradoc's,
I answer hard acrostics, I've a pretty taste for paradox;
I quote in el-e-ga-ics all the crimes of He-lio-ga-ba-lus,
In conics I can floor pe-cu-li-ar-i-ties pa-ra-bo-lous.
I can tell undoubted Raphaels from Gerad Dows and Zoffanies,
I know the croaking chorus from the "Frogs of Aristophanes."
Then I can hum a tune, of which I've heard the music's din afore,
And whistle all the airs from that infernal nonsense, "Pinafore."

But my *military* knowledge, though I'm plucky and adventury,
Has only been brought down to the beginning of the century;
But still in matters vegetable and animal and mineral,
I am the very pattern of a modern major-gineral.

After reading this, if there is any one in the house who thinks a mere aviator's test is at all hard, we give up absolutely!

The Only Way

The Irish sergeant had a squad of recruits on the rifle-range. He tried them on the five hundred yard range, but not one of them hit the target. He tried them on the two hundred yard range—not a hit. He tried them at fifty yards—clean miss. He looked around in despair. Then he straightened up. "Squad attention!" he shouted. "Fix bayonets! *Char-r-ge!*"


CAN YOU MAKE YOUR FOLKS OUT MISS PERKINS, OR SHALL I DROP BELOW THE CLOUDS A BIT
STAY RIGHT WHERE YOU ARE, COLONEL I CAN SEE THEM DISTINCTLY!
NONSENSE! PAW! SCIENCE HAS ABSOLUTELY ELIMINATED ALL DANGER OUTTA AVIATION THESE DAYS!
Poo! Poo!
MATTER OF FACT POLLY'S JESS AS SAFE UP THERE IN THAT AIRSHIP AS SHE'D BE, RIGHT HERE IN THIS FLIVVER!
MY ARGUMENT EXACTLY, MISSUS PERKINS.
BAM!

Courtesy N. Y. Evening Journal.

AERIAL COAST PATROL
Unit No. 3

Invites twelve college men to join the Unit, to form a third division.

Splendid opportunity for young men wishing to train themselves so as to be of utmost service to the country in case of need. Expert instructors and standard flying equipment.

Address Clinton D. Backus, Chairman Executive Committee, Aerial Coast Patrol Unit No. 3, Third Naval District, Mastic, Long Island, Post Office, Moriches, N. Y.

Maryland Aero Co.'s Twin-Motored Flying Boat

THE Maryland Aeroplane Company was incorporated at Baltimore in February of last year for the purpose of building aircraft for exhibition flying and for passenger service. The officers of the company are Mr. Robert Stewart, Pres.; Mr. Elmer Runge, Vice-Pres.; Mr. Otto Melamet, Sec'y; Mr. Earle Hipple, Treas., and Mr. Charles Thoms, Supervising Constructor.

A number of machines have been built but the company has specialized principally on flying boats. The illustrations show the latest model 4-place twin-motored flying boat, the most interesting feature of which is the method of suspending the motors. By such a method, the motor suspension is independent of the wing structure, thus eliminating one of the principal objections to twin motors. The entire weight of the motors is directly transmitted to and carried upon the boat hull, making possible the employment of wing construction of the same lightness as used in single-motor installations.

The general specifications of the machine are:

Span, upper plane	56′-0″
Span, lower plane	42′-0″
Chord	5′-6″
Gap	6′-6″
Angle of incidence	7°
Net weight	2200 lbs.
Motors (2) each 90 h.p.	180 h.p.
Speed range	65-38 m.p.h.

The hull has a beam of 46 inches; the bottom is of the double V type. Overall length, 32′-0″. Provision is made for four passengers, and dual Dep control is installed.

The power plant consists of two "E.N.V." motors. These motors each have 8 cylinders, arranged V type, delivering 90 h.p. at 1250 r.p.m. A radiator for each motor is situated at the forward end. Propellers are three-bladed, 7′-9″ in diameter, with a pitch of 5′-3″. Capacity of fuel tanks, 40 gallons.

A single motored 2-place sport machine, quite similar in design, but smaller in proportion, is being turned out by the Maryland Co. This shows a remarkable performance with a 75 h.p. motor, and the company is now concentrating its efforts upon the production of the smaller model.

To "The Grand Old Man of the Navy," the Late Rear Admiral Jno. H. Upshur, Retired

Tho more than four score years and ten,
The fire of youth shone in his eye,
An ornament to world and men,
His graceful thought was ever nigh.

To man and woman, girl and boy,
To Prince and servant, just the same,
His presence was a constant joy
That gave to him enduring fame.

His mind was clean as limpid stream,
His heart was pure as precious gold,
His generous impulse could be seen
In beauteous guise and manifold.

A tender father, friend so true,
A gentle husband full of grace,
In sun or cloud, whichever grew,
Nobility beamed in his face.

His book of Life is spotless white,
So turn the pages as you will
You see reflected honour bright,
Ideals so high the heart to thrill.

The quiet bravery of the man
Was demonstrated in every deed,
As thru his veins the red blood ran
He carried out the highest creed.

A Christian soldier of our land
He stood to give his very all,
To offer up his heart and hand
And hasten to his country's call.

Oh! Bayard of America,
Thou Chesterfield personified,
Without reproach, without a fear,
Tho seeming gone you have not died.

GEORGE L. UPSHUR.

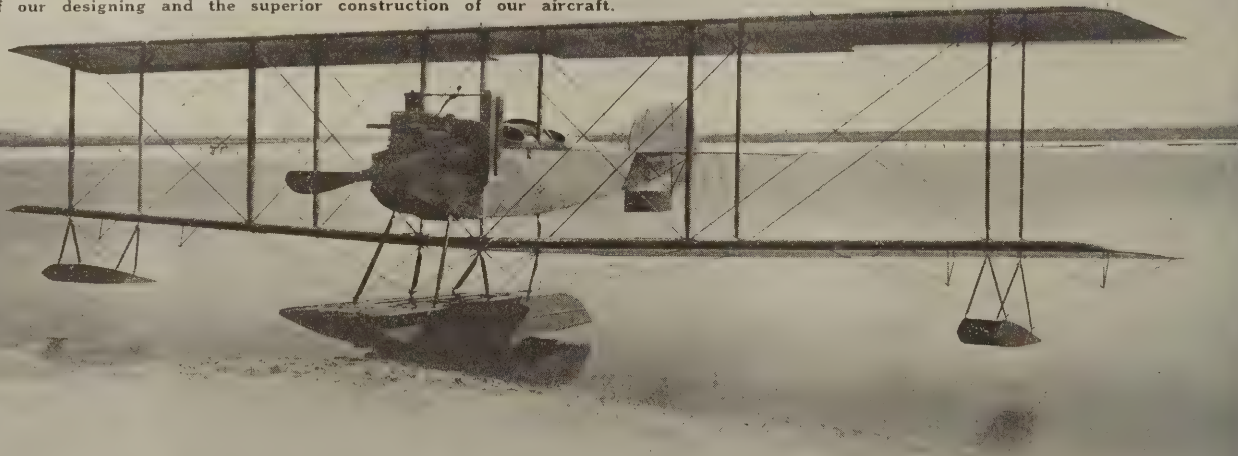
THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.



WRIGHT-MARTIN AIRCRAFT CORPORATION

60 Broadway -:- New York

Army and Navy News

Capt. James F. Byrom, junior military aviator, Signal Corps, is relieved from detail in the Aviation Section of the Signal Corps, to take effect May 21, 1917. He is assigned as a first lieutenant to the Twenty-first Infantry, to take effect May 22, 1917, and will proceed, to join that regiment. The travel directed is necessary in the military service.

Sergts. Philips D. Smith and Logan T. McMenemy, of the Signal Enlisted Reserve Corps, are relieved from duty at the Signal Corps Aviation School, Mineola, Long Island, N. Y., and will proceed to Washington, D. C., for duty in the Signal Corps General Supply Depot at that place. The Quartermaster Corps will furnish the necessary transportation and pay these soldiers commutation of rations in advance for the necessary number of days' travel. It being impracticable for these soldiers to carry rations of any kind. The journey is necessary for the public service

Sergt. Harold E. Mensch, of the Signal Enlisted Reserve Corps, is relieved from active duty at the Curtiss Aviation School, Newport News, Va., to take effect May 23, 1917, and will proceed to his home. The Quartermaster Corps will furnish the necessary transportation and pay this soldier commutation of rations in advance for the necessary number of days' travel, it being impractical for this soldier to carry rations of any kind. The journey is necessary for the public service.

Under the provisions of section 55, act of Congess approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt. John Wentworth on active duty in the Aviation Section of the Signal Enlisted Reserve Corps Aviation School, Chicago, Ill., to take effect May 15, 1917, is confirmed.

Pvt. James A. Wilson, Signal Corps, Signal Corps Aviation School, Mineola, Long Island, N. Y., will be sent to Hampton, Va., for duty at the Signal Corps Aviation Station and Proving Grounds.

The following named enlisted men, Signal Corps, Signal Corps Aviation School, San Diego, Cal., are announced as on duty that requires them to participate regularly and frequently in aerial flights from dates indicated;

Master Signal Electricians Samuel V. Schmerhorn and Nemo S. Jolls and Sergt. First Class Henry Daum, from May 2, 1917.

Sergt. First Class Albert A. Fletcher, from May 1, 1917.

Sergt. First Class Fred Parkins, from April 24, 1917.

Under the provisions of section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt. Kellogg Sloan on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, Mineola, Long Island, N. Y., to take effect May 15, 1917, is confirmed.

Under the provisions of section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing Sergt M. E. Carter, Jr., on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, Memphis, Tenn., to take effect May 15, 1917, is confirmed.

Under the provisions of section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army placing the following sergeants on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, Essington, Pa., to take effect May 15, 1917, is confirmed:

Brooke Edwards.
George B. Patterson.

The Sperry Automatic Pilot in Action

In the course of his always interesting "Notes from Paris," Douglas W. Thorburn in our London comtemporary, *Flight,* has something to say about the Sperry Automatic Pilot. The piece follows:

A Little Looping.—There is an old story, which may be new to some of my readers, of a man who was sent to take an inventory of the furniture and contents of a certain house. Unfortunately there happened to be a bottle of whisky on the sideboard, and this somewhat hindered his work, for later in the day he was found asleep under the table, with the empty bottle on one side of him, and on the other a notebook containing the solitary entry:—

"1 revolving carpet."

I can now sympathize with the feelings of that man, though I hasten to add from an entirely different cause. At a certain aerodrome not far from Paris I was introduced to a well-known pilot of much experience, who offered to take me for a flight. He said nothing about looping, and I did not mention the fact that I had already looped with various aviators on various types of machines, but apparently, while I was engaged in a desperate struggle with a fur-lined flying suit, someone gave him some private and confidential instructions which I did not hear. And I know who did it, too! It was a day of frequent snowstorms and a strong wind, but the machine—a twin-engined Caudron, fitted with a Sperry Automatic Pilot—climbed rapidly and rode through the storms with wonderful steadiness. After the first few minutes the human pilot switched on the automatic control, and the manner in which the machine stabilized itself was amazing. I have always looked on the gyroscope principle with great respect, but the ingenious manner in which it has been utilized by the Sperry Company is something which every pilot ought to see and to test for himself. This, however, is a subject which deserves an article of itself. After a short time we found ourselves 3,000 feet over the famous Palace at Versailles, and I was charmed with the view. One would almost think that the palace and park had been laid out solely with an eye to the effect as seen from the air. Its broad straight avenues, stately courtyards, and ornamental fountains and lakes amid the trees looked exactly like some wonderful carpet pattern. Suddenly, without a word of warning, while I was comfortable admiring the scene, the machine stood on its nose and commenced a vertical dive. I smelt a loop, as one might say, and ought not to have minded, but being taken completely by surprise I involuntarily looked down at the floor to avoid the spectacle of the earth going over my head. This only added to the effect of the thrill, for between my feet was a large square hole intended for a camera to be fitted, and in consequence I saw through it blue sky and fleecy clouds whirling beneath me. It was most disturbing, and when we came back into a normal position I looked around at my pilot, more in sorrow than in anger. He smiled a wicked smile at me and looped again, and then went one better and did two more horrid loops sideways. These were the most confusing movements I have ever experienced in the air, and I am not quite sure even to this day how he did them. After the first loop I looked over the side all the time, and as I saw the pattern of the wonderful park at Versailles whizzing over my head and round my neck and disappearing down my back, I should like to have taken out a note-book and written down the one item:—

"I revolving carpet."

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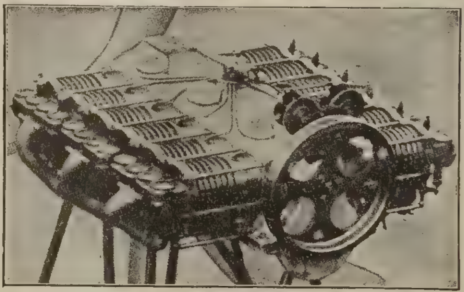

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Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
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Flying for June

How the navies of the world use Aircraft Motherships is discussed in a ten page, profusely illustrated article by Henry Woodhouse.

Admiral La Caze, the French Minister of Marine, reported to the Chamber of Deputies recently that France has 552 coast patrol units, with seaplane stations all along the coast, so that the zone of action of each joins that of its neighbor. Admiral La Caze's statement, illustrated by the types of seaplanes used in this work, appears in Flying for June.

Amongst other important subjects dealt with in this issue are: Plans and Personnel of the Aircraft Production Board; Balloon Training; Hunting Submarines from the Air; Rules and Regulations Governing Aerial Reserve Corps; and News of the Aerial Coast Patrol Units.

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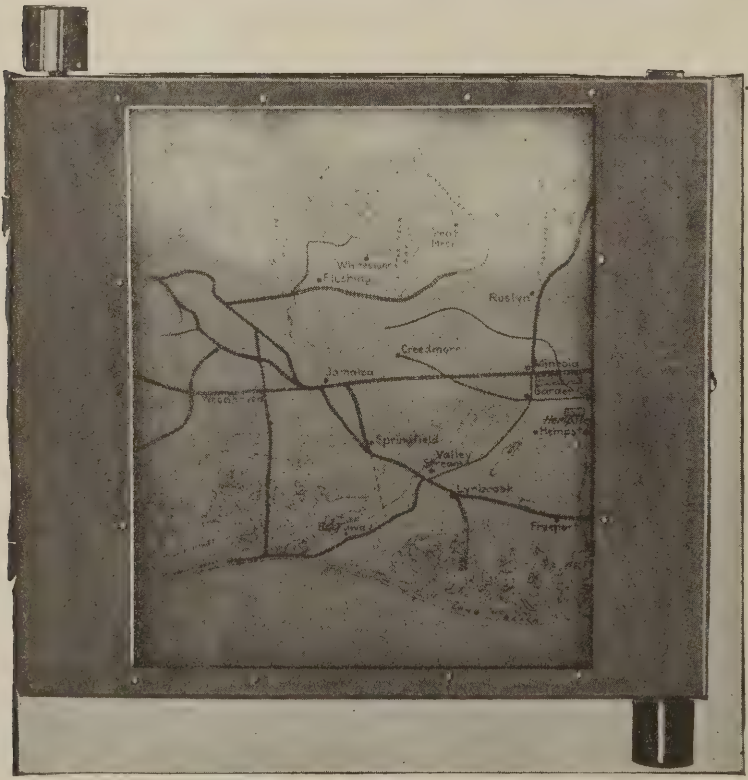

ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps and Sperry Map Holder, supply this necessity.

The map can be turned easily in the holder bringing constantly before the aviator a chart of the locality above which he is flying.

The equipment is light in weight and can be fixed to instrument board without interference with the other instruments.

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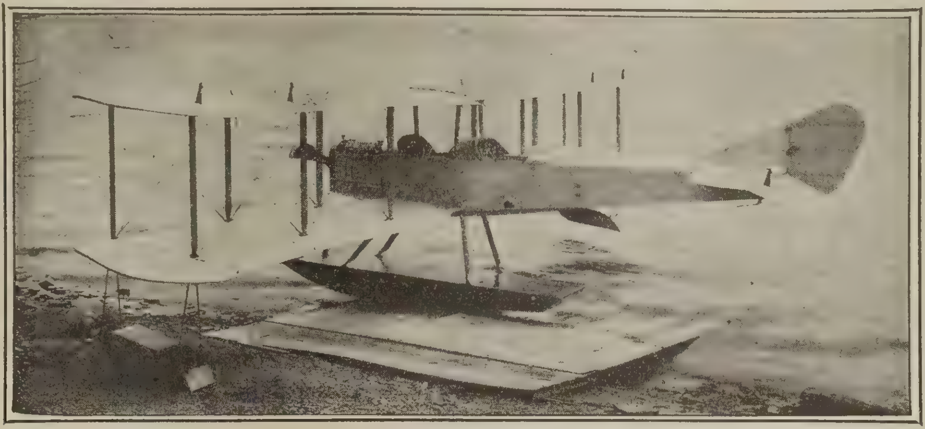

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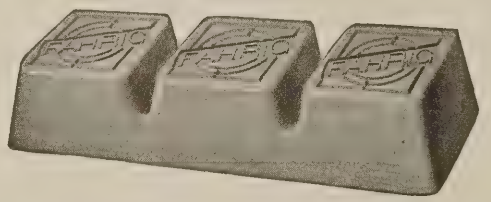

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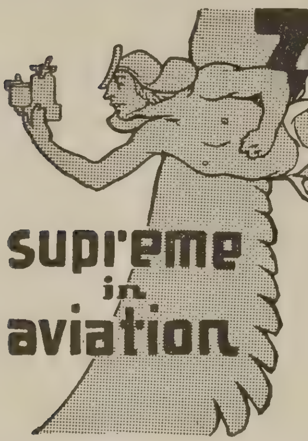

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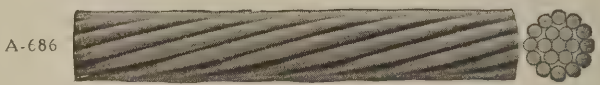

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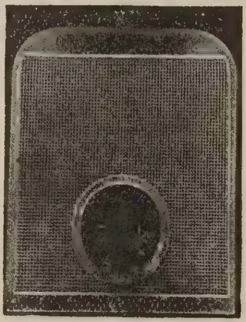

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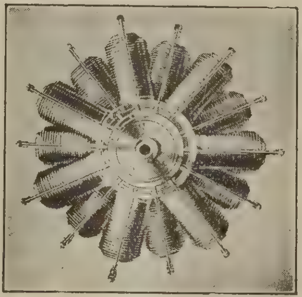

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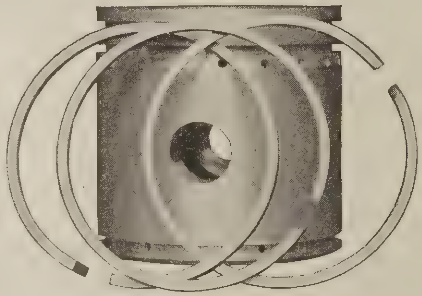

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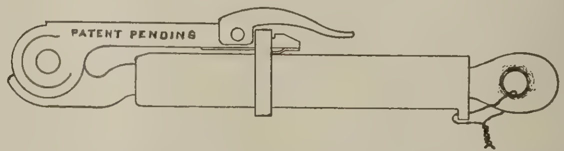

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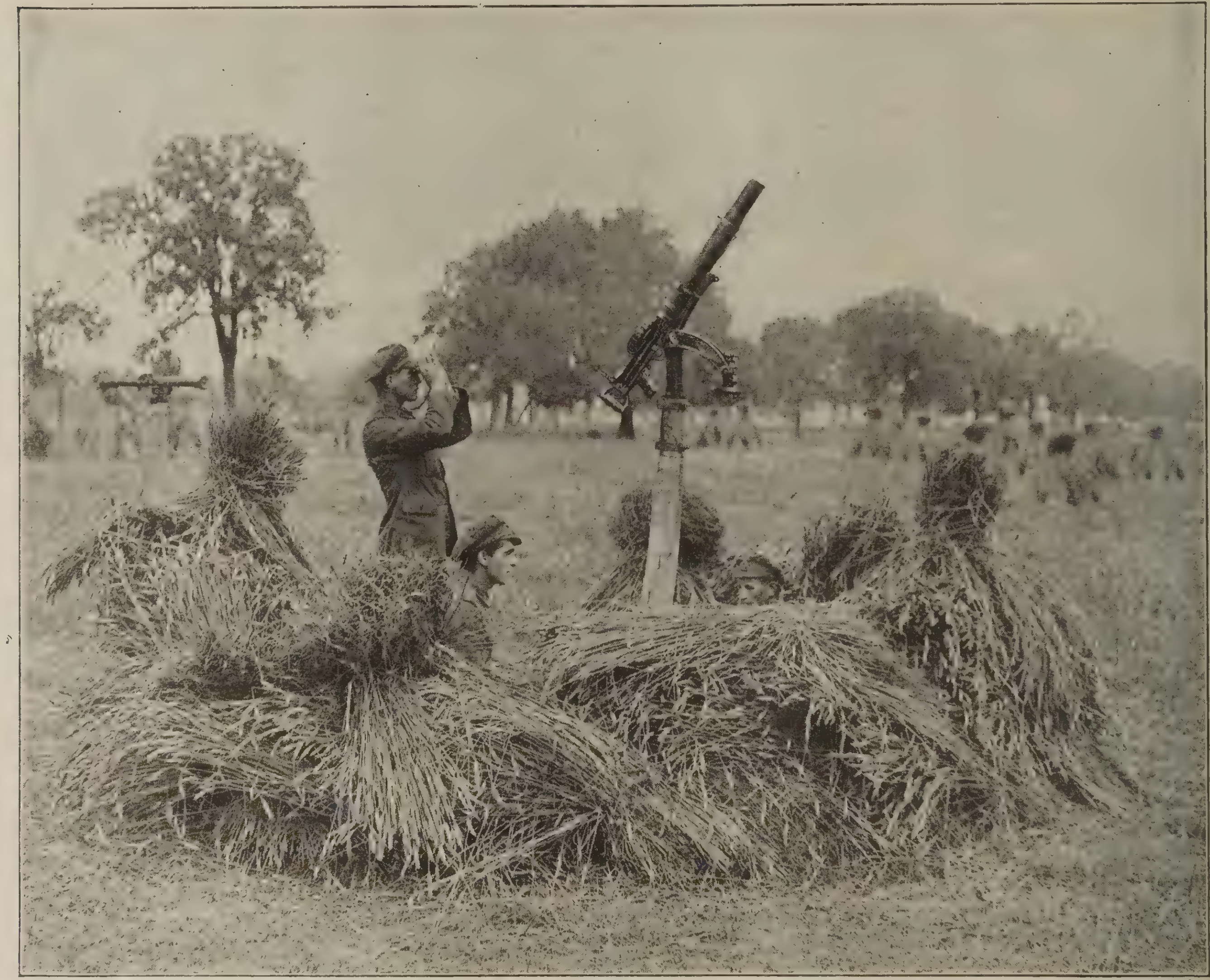

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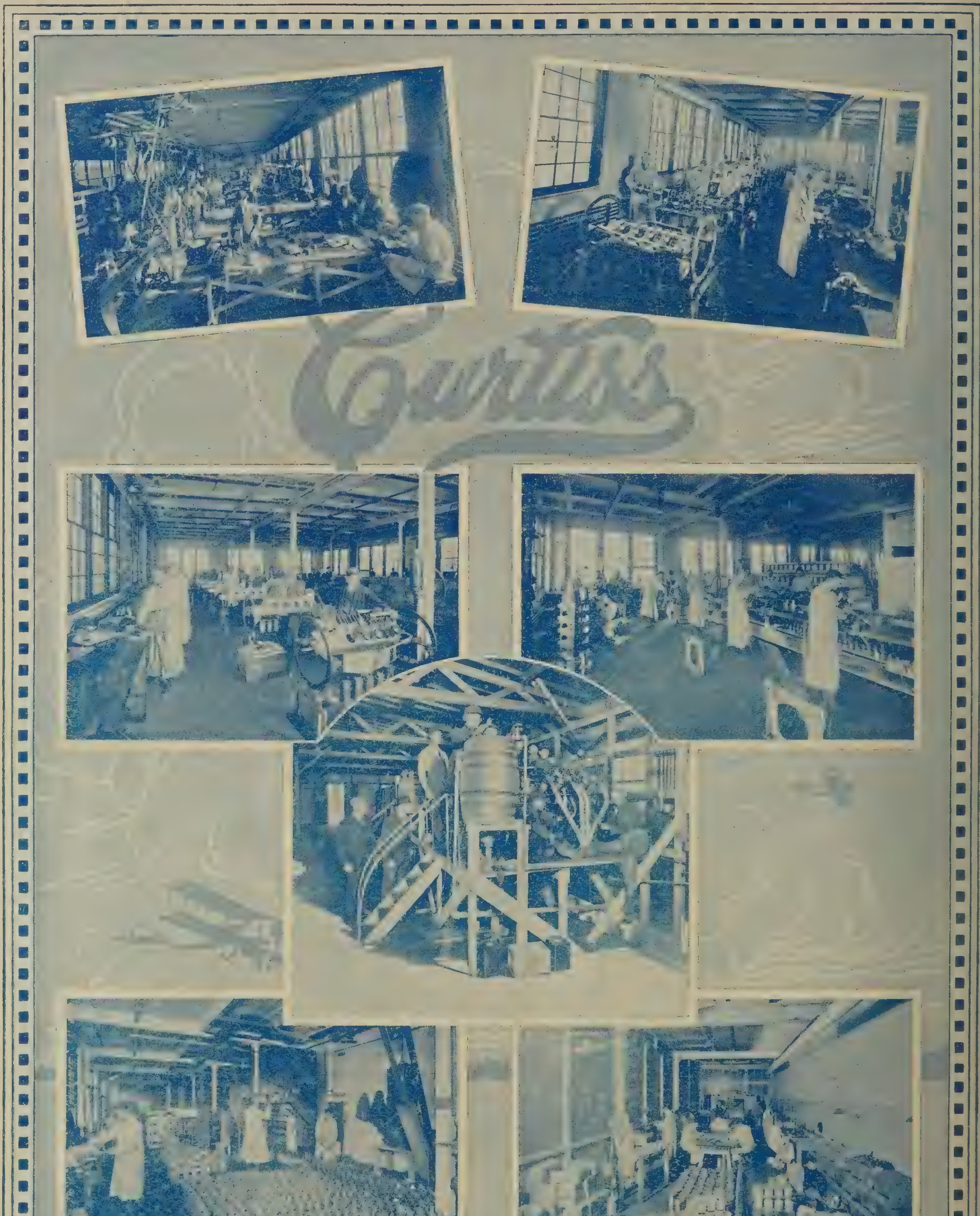

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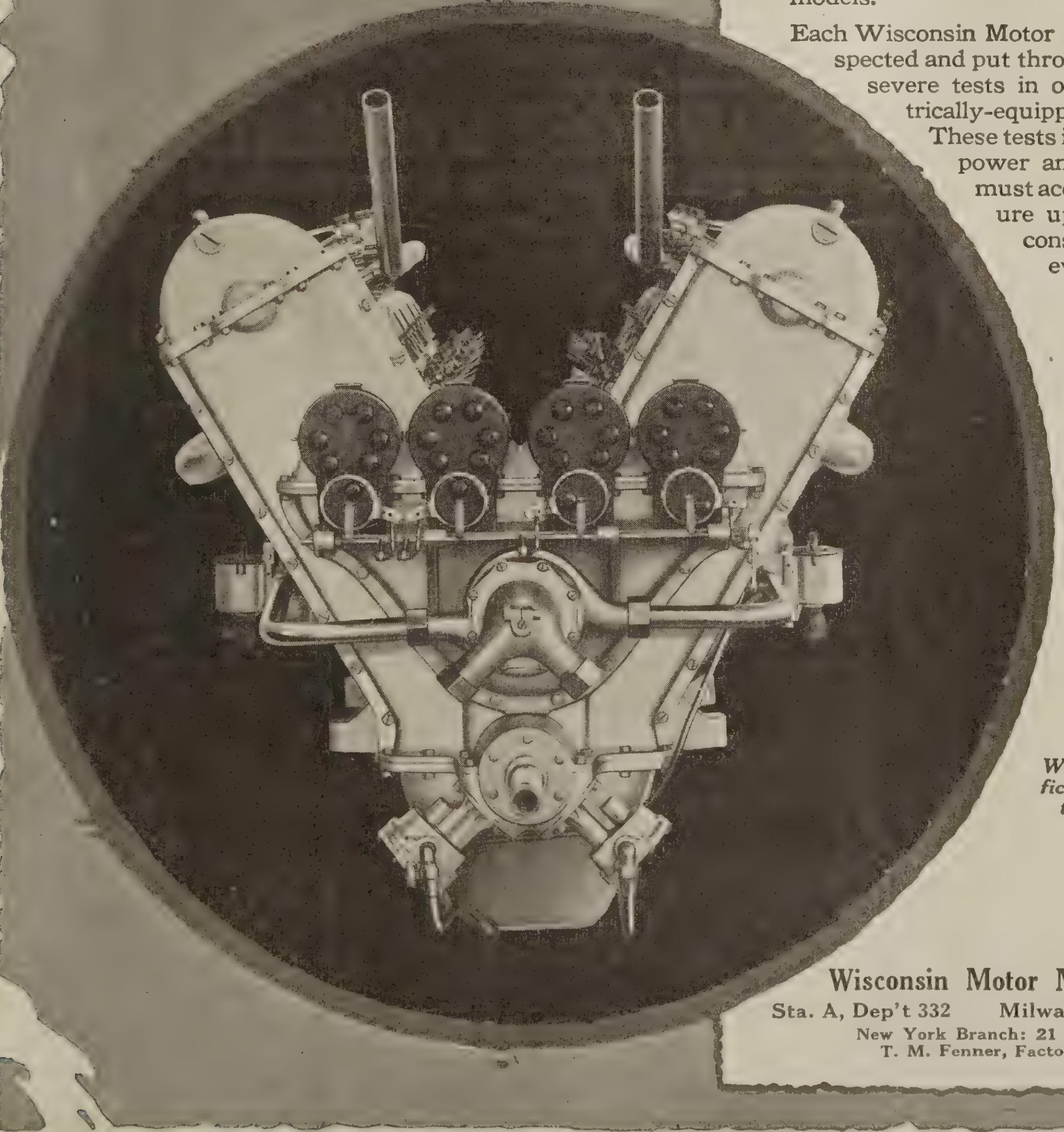

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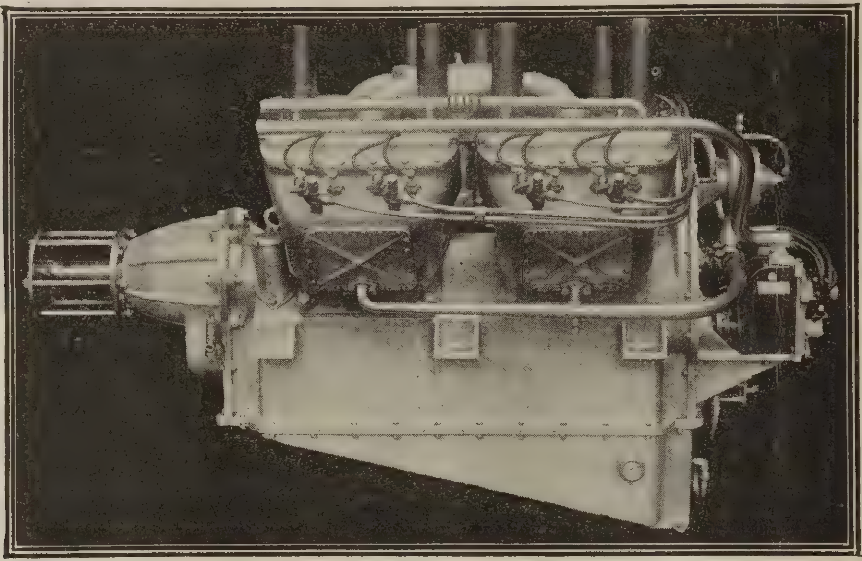

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First: They are lighter in weight.

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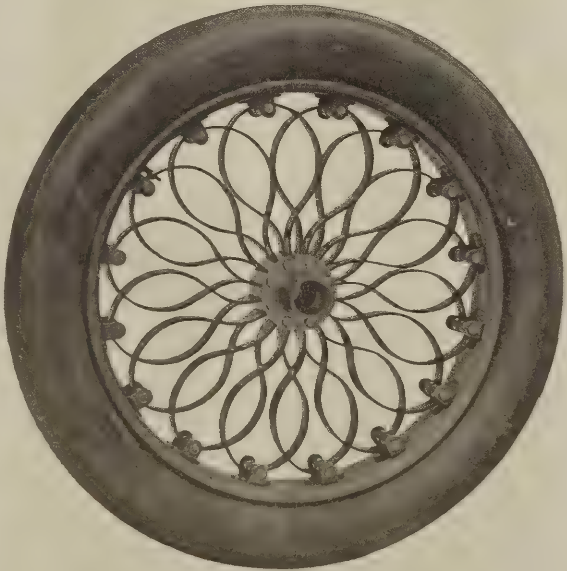

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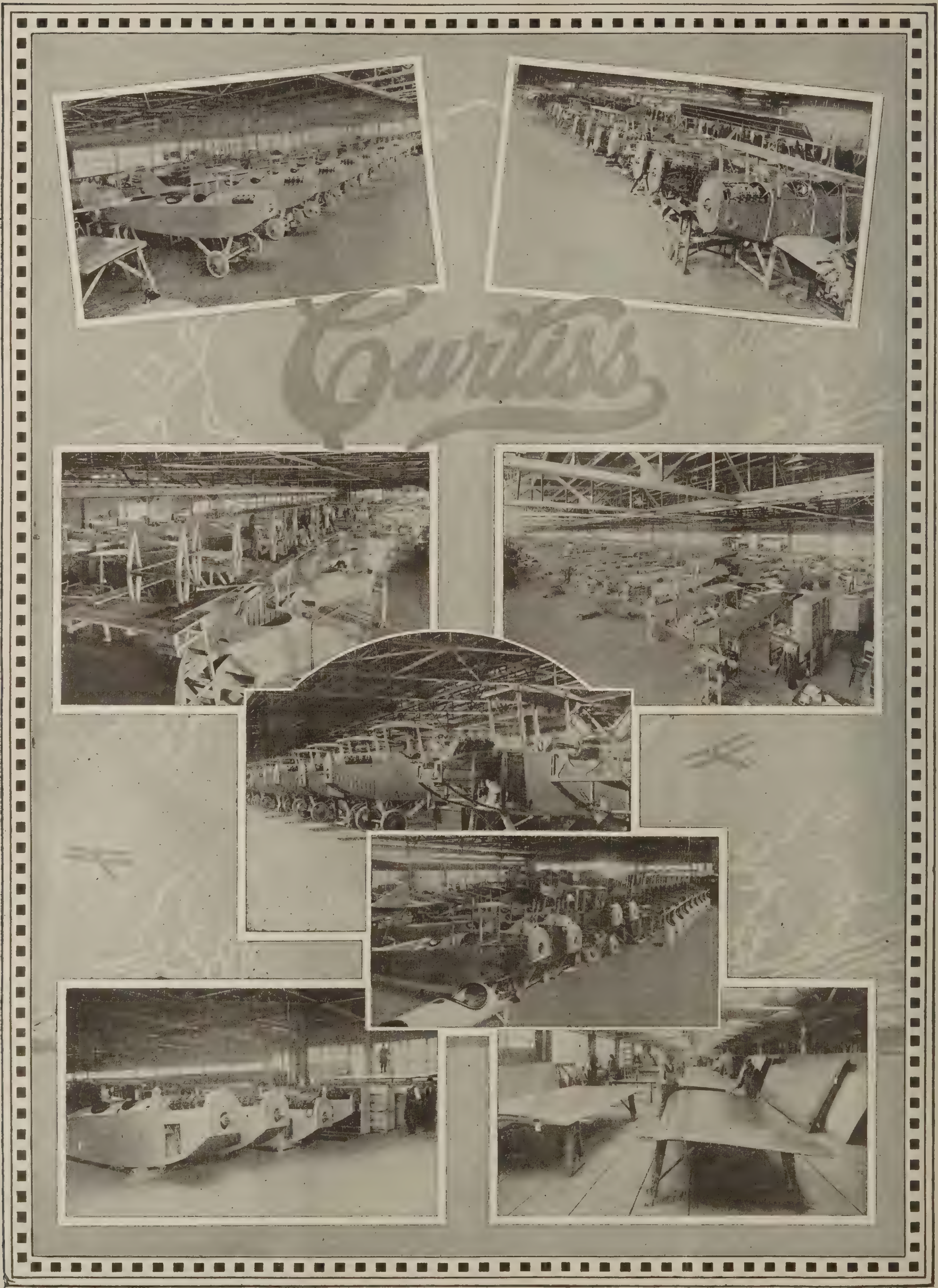

Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities

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THE TRADE AUTHORITY
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Subscription Price, $4.00 a year, Foreign, $5.00. Telephone, Murray Hill 7489

VOL. V NEW YORK, JUNE 25, 1917 No. 15

PRESIDENT WILSON AND SECRETARY BAKER BACK OF PROGRAM FOR $600,000,000 FOR AERONAUTICS

PRESIDENT WILSON and Secretary Baker are now behind the campaign for the immediate upbuilding of our aerial defenses.

"The War Department is behind the aircraft plans with every ounce of energy and enthusiasm at its command," Secretary Baker said in discussing the plans of the Aircraft Production Board and the Signal Corps to strike at Germany in the air. "The Aircraft program seems by all means the most effective way in which to exert America's force at once in telling fashion.

"We can train thousands of aviators and build thousands of machines without interfering in the slightest with the plans for building up our armies and for supplying the Allies with food and munitions. To train and equip our armies and send them abroad will take time, however, and in the meanwhile we can be devoting to this most important service vast quantities of productive machinery and skilled labor which otherwise could not be contributing to the nation's cause in full proportion to its capacity.

"Every consideration points to the effectiveness of a highly developed air service in its relation to the part which the United States can play in putting an end to the war. It lives up to all America's traditions of doing things on a splendid scale, it will put us on our mettle from the point of view both of mechanical ingenuity and of individual daring and initiative. At the same time compared with the transportation of an expeditionary force of infantry and artillery large enough to be decisive value on the western front it offers little or no difficulty. All through the coming year we shall have to reckon with the shipping problem, and whatever aid we send abroad, whether in men or in supplies, must be calculated for securing as efficient a use as possible of available tonnage.

"The aircraft plan meets the demands of the situation. Under existing conditions of fighting, where the Allies and the Germans are fighting on practically even terms as regards man-power and aircraft, the addition which we can contribute to the Allied air forces will be proportionately of far greater value than the immediate aid which we can furnish on land. According to the best obtainable information there are about 7,000,000 men on the western front today. The addition of a few infantry units, while of great moral value, little in forcing a decision. A few thousand trained aviators, however, with the machines for their use, may spell the whole difference between victory and defeat. The supremacy of the air, in modern warfare, is essential to a successful army. America must make sure that the Allies and not Germany secure the permanent domination of the air and that within the year.

"It will take no more shipping space to send a thousand air pilots abroad than a thousand infantrymen; it will take no more space to send aeroplanes and motors than to send artillery. It is now certain that if we make the effort we can send enough of both men and machines within a year to be of great value, perhaps to turn the scale, all without handicapping our plans for the army which is to follow, nor hindering the vital flow of food and munitions.

"American airmen and aeroplanes may turn the tide. They furnish our supreme opportunity for immediate service on the fighting line."

EXTENSIVE AERONAUTIC PLANS DISCUSSED BEFORE SENATE COMMITTEE

THE American authorities have been informed by the British and French that, if the United States will supply them immediately with aeroplanes and aviators commensurate with this country's manufacturing resources, it will unquestionably contribute more to the success of the Allied cause and the defeat of Germany than the sacrifice of thousands of American lives on the western front later on.

"We may as well realize now," Mr. Howard E. Coffin said, "that the domination of the air will in all probability prove the deciding factor in the struggle in the present war on sea perhaps as well as on land. Military authorities of all the Allied nations are agreed that unless the Allies can secure a preponderance of aircraft with which to overwhelm the German lines, the war may and probably will drag on for years, with a constantly increasing toll of lives.

"We believe now that we have worked out a program which will make it possible for the United States to secure to the Allies next year the permanent supremacy of the air, and with that we hope to become an immediate deciding factor in ending the war. Whether this program can be carried out will rest with Congress. It has progressed far enough, however, for us to say that a greatly increased American output of aircraft and aviators seems a practical possibility. As soon as the proposal is placed before Congress, we shall ask the American people and their official representatives in Congress for their hearty support of the plan.

"In the meantime, it must be made plain that the struggle for the supremacy of the air is perhaps the most vital of all the methods of fighting in which the United States can take part. A superiority in numbers of several hundred thousand men on the Western Front means little comparatively under modern conditions of fighting. All the men we can send from now on are needed badly, but we cannot send an army large enough the first year to become the deciding factor, and we must strike in some way at once. The air furnished the way. A vast superiority in aircraft means the complete blinding of the enemy. If his machines are driven out and kept out of the air it means that he has no facilities for sighting his long range guns; it means that he has no means of getting charts and photographs of the opposing lines nor of preparing and meeting attacks properly, and it means that his own communication lines are constantly subject to damaging raids and even to complete destruction. In modern warfare the army without aircraft is practically helpless against one fully equipped with air fleets.

"In the present struggle between Germany and the Allies the fight for supremacy in the air is practically even; they are constantly struggling for the advantage. It is a nip-and-tuck race both in manufacturing and in fighting. Each side is seeking to outdo the other in numbers, speed and fighting efficiency. Germany has the supremacy in manufacturing organization; the Allies in aggregate resources. There is every reason to believe that neither alone can secure a definite and permanent supremacy. This is America's one chance for turning the scale next year. She cannot equip and send over enough troops and military supplies to determine the war before that time, although all she can send will be necessary. We must throw in our weight to a far greater extent than would be made possible by the dispatch of troops alone if we expect to have our force turn the tide within the year. This is a time for frankness. Everything combines to prove that it is in the air that the United States has its greatest chance to outmanoeuvre Germany.

"To do it we must be prepared to spend not a few millions, but hundreds of millions of dollars. We should not hesitate to sacrifice any number of millions for the sake of the more precious lives which the expenditure of this money may save. We need not speak of the much greater amounts of national wealth which an immediate expenditure of generous proportions made now may save. Great Britain's last appropriation for aircraft alone was $600,000,000. Her appropriation for the present year will probably approximate a billion. France has spent an equal amount on her air program. The United States, in the face of the existing situation, cannot afford to be niggardly.

"Our resources are unbounded. We now have the program which will make it possible to get an adequate return from those resources. America must establish a permanent supremacy of the air and shorten or end the war. It seems now the only way for us to quickly weight the balance on the side of the Allied powers and turn the scale within a year or two."

Lieut.-Col. L. W. B. Rees, of the British Royal Flying Corps, appeared before the Senate Sub-Committee on the Sheppard-Hulbert Bill, which has amongst its provisions the appointment of a Secretary of Aeronautics. We give the important parts of his testimony:

Senator Sheppard: Lieutenant-Colonel Rees has kindly consented to give us the value of his views and experience, at my request, and I will be very glad if the Colonel will tell us something of the necessity of the development of air service, and of its concentration under one authority.

Col. Rees: Originally the air service was represented by the balloon section, corresponding to your signal corps. It was just one company, and they trained a certain number of men to be gunners and for aerial observation. In September, 1912, we started what we call the Central Flying School, and we trained pupils for aviation there, and sent them out from the Central Flying School, which was both naval and military, to the army wing and the navy wing of the flying corps. That worked very well, at that time, because we all met at the Central Flying School. We had certainly not more than 20 pilots in the army and 20 pilots in the navy, and we knew all we were doing at that time.

The pupils themselves, to get into the Central Flying School, had to pay for their own brevets, that cost them 100 pounds, so that many of the people we would have liked we could not get. We got lots of people who did nothing, but the working people could not pay for it, so a lot of people came in whom we did not want at all.

When the far started, in 1914, they had a Royal Aircraft Factory, which looked after designs more or less. It was supposed to look after designs for both the navy and army, and to a certain extent it did. But it was much more army than navy. There was no naval officer in the Royal Aircraft Factory. The Royal Flying Corps was also still army and navy, but it became more army, and there were few naval cadets. At the beginning of the war the navy had some dirigibles and seaplanes, and the army had the first machines, and at this time the army and the navy had absolutely gone apart. The army was the Royal Flying Corps, not the army wing, and the navy, instead of being the navy wing, was the Royal Navy Air Service, with the consequence that the engines were different, the designs were different, and everything was different altogether. The officers on both sides were designing the same things and getting different results. Even our bomb carriers, for instance, were different. The navy had one bomb carrier, which you pulled like this, and we had a bomb carrier, and to drop the bombs we had to go down to our feet and pull a sort of a little ring in our seat, and that wasted a lot of time.

Again, when the war started, the navy, having seaplanes, saw no service at the front. They were the coast patrol, and they did not really know what was happening at the front. They sent a certain number of people over to the front in the land machines, so they kept in touch with what was happening at the front. They were so far apart then that the information did not come through. They had to go to get their own information.

About six months after the war started the actual delivery of machines began to worry us, because the army would send down and say they wanted so many machines and engines, and the navy would send down the same. The army used to send down a civil inspector to inspect the machines, and the navy would send down in many cases a warrant officer.

Senator Brady: To make the inspection?

Col. Rees: To make the inspection. These Vickers machines, which I happened to fly at that time, we had very good inspection of. Our tail booms were about so thick (indicating), and the navy's were about so thick, and I was told to take over one to Dover, and looking behind I saw these things bending. I said, it is bad inspection. So I landed and put on a splint. But they evidently were not fit to fly as they were. If the army is in a hurry for these things they send down a note to the factory and say, "We want this urgently." The navy send down to the factory and says, "We want this more urgently still." So the poor factory man did not know where he was, did not know which to supply at all.

Then, another thing, looking after our supply, we have officers who are just officers in the army, and did not know anything about this, did not know anything about factories. They were told to get on the job and do all they could. They were not really in touch with the manufacturers, so that at the beginning of this year we formed the Air Board. The duty of that board is to coordinate the army and navy.

Senator Sheppard: Is that independent of both?

Col. Rees: Yes. We still left the Royal Flying Corps and Royal Navy Air Service, and on top we have the Air Board.

Mr. Hulbert: These two services you speak of are now a part of the air service?

Col. Rees: They work under it, yes.

Mr. Hulbert: Who is the head of the air service?

Col. Rees: It was Lord Cowdry. It is Winston Churchill now.

Senator Kirby: Your air board is superior to both the army and navy, and it controls them both?

Col. Rees: Yes.

Senator Sheppard: As far as flying is concerned?

Col. Rees: Yes. I think we have a neutral person who is a member of the cabinet. He is a representative of the army and the navy, the director of aeronautics.

Senator Brady: You say you have one a member of the cabinet who has charge of the air work?

Col. Rees: Yes, a neutral, who is a member of the cabinet.

Mr. Hulbert: That is Churchill now?

Col. Rees: Yes. That is neither army or navy. Then also you have the representative of the army and you have the representative of the navy.

Senator Kirby: Do they constitute the air board? Who is the air board?

Col. Rees: Besides them we have two representatives of munitions.

Senator Kirby: Five members?

Col. Rees: Five members, and there may be more.

Senator Kirby: I am just trying to get at who is in charge.

Col. Rees: The army, the navy and munitions are represented.

Senator Sheppard: Is this new member made a member of the cabinet?

Col. Rees: I understand so, yes.

Admiral Peary: He is the Air Minister, I think they call him.

Col. Rees: Yes. The director of military aeronautics is also a member of the War Council. Then the naval and the military boards put forward what they call an air board, and the head of the air service gets what he wants from different fronts, and he is kept in touch with them from the different fronts. The members of the ministry of munitions say all they have, and then there is a duty of the neutral president to apportion out what he wants, so that there is no overlapping at all now.

Senator Brady: You have one man who has supreme authority all the way down the line?

Col. Rees: Yes, the air minister.

Senator Sheppard: And he is a member of the cabinet?

Col. Rees: I understand so.

Senator Brady: Do you find that much better than the old plan of a divided authority?

Col. Rees: It is ever so much better. We do not know how much better it is going to be yet.

Senator Brady: You think it is a great improvement in the service?

Col. Rees: A great improvement.

Senator Kirby: There could not be any doubt that, if what he said was a fact about the army and navy manoeuvers, each one acting without regard to the other.

Senator Brady: The same way we are doing here. The army is doing its part and the navy its part, and nobody to coordinate them.

Senator Shepard: It is your view that the coordination of all the different branches of the air service under one authority has been extremely beneficial?

Col. Rees: I think there is no doubt about it.

Senator Sheppard: In fact, it was very necessary and indispensable?

Col. Rees: I think so myself, yes, sir.

Senator Sheppard: Has any attempt been made to develop the commercial possibilities of the air service?

Col. Rees: No. Hitherto we have been too busy over our own army and navy.

Senator Sheppard: Have you made any study along that line yourself?

Col. Rees: Not commercially. I only study it from the army point of view.

Senator Sheppard: Do you think it is going to become more and more effective as a weapon of war?

Col. Rees: Oh, yes. It is simply a question of the number of planes.

Senator Sheppard: Do you mean the determination of the war will be dependent on the number of planes?

Col. Rees: Not altogether, but at the present moment our most pressing need is photography and reconnaissance to keep the general staff informed, and we have hitherto not had enough machines to go bombing with, because we dare not lose our machines bombing, because then we would not have enough machines for the collection of information.

Senator Sheppard: But you are developing the plane into a more effective fighting machine all the time?

Col. Rees: Yes. The most important thing is information, and to protect your machine you must have your fighters, because the reconnoissance machine cannot fight. He must look at the ground, and you must have your good fighters to protect him, and he must know he will be protected; otherwise he will be looking all over the air.

Senator Kirby: You talk about protecting your reconnoissance machine. Do you have fighting machines to go with you to do that?

Col. Rees: Yes, you go with your fighters complete, just as you would in the navy and the army. You have your protectors.

Senator Sheppard: The reconnoissance machine is not armed?

Col. Rees: It is armed for defense. You sweep the whole front with your offensive patrols, so that there ought not to be anybody collecting, but if they do collect, you have your fighters with the reconnoissance machines, and the same with the bombing. Your bombing machines have to go low. When a machine at a height goes over an aerodrome, this machine cannot get out and attack it. But if you are flying low, the machines from the aerodrome can get out and attack it. So that you lose a great many bombs if you do not have many fighters. Any bomb you drop on a railway now means eight hours' work for a railway detachment.

Senator Sheppard: Did you notice the dispatches describing the battle at the Messines Ridge, where it was said the aeroplanes actually took part in the fighting itself?

Col. Rees: We started that on the Somme last July.

Mr. Hulbert: You are convinced now, from the progress of the war, that aviation is becoming more and more an important element, and contributing more as a determining factor?

Col. Rees: All the time, yes.

Mr. Hulbert: From your experience in the British army, you appreciate the real necessity for having coordination of all aeronautical activities under one head?

Col. Rees: I think you must have. There is no doubt about it.

Mr. Hulbert: Your Air Board in Great Britain now bears the same relation with regard to aeronautics that the Minister of War and the Minister of Navy do with regard to the army and the navy, as I understand you?

Col. Rees: That is practically so, only we still keep our names, the Royal Flying Corps and the Royal Navy Air Service. We have not yet got as far as making them one, but they will, no doubt, become so.

Senator Brady: Do you have any trouble in securing recruits for the air service?

Col. Rees: They are not quite such a good class now as they have been, except the young men. But some of the men coming back from the front are coming back on account of a variety of reasons.

Senator Brady: The only way to get them would be by volunteer service?

Col. Rees: Yes.

Senator Brady: It would be almost impossible to get a man that your department would want to be in charge of an airship if he did not volunteer to do that service?

Col. Rees: He would not be any good at all. It absolutely depends on the individual, because from the start it is our rule always to go to the Germans, and that has helped many machines indeed, because our older machines could not fly to the front, so when the Germans got quick fighters, they could fly all around them, so it was our rule to go after the Germans.

Senator Brady: What pay do the soldiers in the aviation service receive over there?

Col. Rees: The third class mechanic's pay I think is a shilling. The second class mechanic gets two shillings.

Senator Brady: It runs about the same as the other service in the army?

Col. Rees: It is higher. The third class mechanic is the same as a soldier. It goes on increasing.

Mr. Hulbert: Increasing in proportion to the danger?

Col. Rees: Not the danger; according to how good he is.

Senator Beckham: Do you believe the Allies are considerably superior to the Germans now in the air service?

Col. Rees: I think so, yes, both the number of machines, and certainly in their personnel. Machine for machine, our machines have been better than the Germans. But they at times collect all their good machines from all the fronts, and they will put those on a twenty-mile front, and one morning you will have many casualties, and then directly after they do that, this time it was a fortnight afterwards, we got our new machines out, and since then I do not think you have seen many heavy casualties. Our new machines were just a fortnight late this year.

ADMIRAL PEARY BEFORE COMMITTEE

ONE of the most striking statements of Admiral Peary in his testimony before the Committee, was that "in the comparatively near future the air service will be more important than the army and navy combined." He asserted that such a statement had been made on the floors of Parliament by such leaders as Mr. Balfour, Lord Charles Beresford, Lord Montague and Lord Northcliffe.

"These statements have been made within the last six months, said Admiral Peary in answer to a question by Senator Brady of the sub-committee. "And those same men are saying also publicly and officially in carefully considered words that the decision in this war may—some of them are now saying will—come in the air, and they are also saying that every country will be forced to have its separate, independent air department to handle this matter. France and Great Britain—and without question probably Germany—have already taken steps to that effect.

"At present the aeronautics for the Government, as you gentlemen are aware, are handled partly by the army and partly by the navy; with the Post Office Department interested with the possibility that mails may be carried by aeroplanes; with the Treasury Department interested with the idea that the aeroplanes may furnish, as they undoubtedly will furnish, a speedy and effective method of patrolling our coasts, an adjunct of the life saving service along our coasts.

"I think it means divided authority, it means dispersed responsibility, it means putting an additional load upon the shoulders of officers and officials who already have all the load that they can carry."

Admiral Peary was not asked if the President or either his chief military or naval advisers had suggested the new department of aeronautics, but inquiry resulted in the discovery that no such suggestion had been made at the White House or in the Department of War or of the Navy. Admiral Peary's testimony evoked great interest, particularly his description of a modern battle array of air fighters.

"There was an article in the papers yesterday," said the Admiral, "written by a correspondent with the French armies in which he spoke of this very matter and described the way in which the air service worked, that 20,000 feet in the air there was a cloud of one man fast machines that were forestalling any possibility of German aeroplanes getting into the aeroplane melee; 3,000 or 5,000 feet up was another division of bombing machines and spotting machines and reconnaisance machines; and down close to the ground, armed with three inch guns and the machine guns, was another numerous division of machines swooping along close to the ground destroying observation posts and stirring up machine gun emplacements."

"If they can carry 4,000 pounds of weight they can carry lots of explosives?" asked Senator Kirby.

"That is only the beginning of the development of the entire science," said the Admiral.

"Is that the maximum load so far?" asked the chairman.

"The Sirkosky machine carries thirty passengers," said Admiral Peary. "That is presumably something over 4,000 pounds. But in the future development there is going to be precisely the same increase in size and carrying capacity that there has been in ships, in locomotives in submarines, or vehicles of any kind."

Admiral Peary added that if there were 1,000 hydroaeroplanes and aviators along the coast it would increase the efficiency of the coast protection 200 or 300 per cent., and that 5,000 of them would be none too many.

AMERICAN PUNCH THROUGH AEROPLANES

"THE American punch must be given through aeroplanes," Gen. Squier said. He favors the building of aeroplanes up to 100,000 if necessary as practical.

"With the wealth we can devote," he says, "and our facilities for manufacturing there is no reason in the world why we should not be able to produce in a comparatively brief period of time an absolutely overwhelming aerial fleet. An army in the air should blind the eyes of Germany until her gunners, absolutely deprived of the range finders, will be put out of business by the allied artillery.

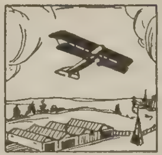
"The modern type of land war is dependent upon two things above all others: aviation and artillery. They are cooperative elements in a fighting army, and against an enemy, a flying machine is a terror and a menace to big guns. That aeroplanes are positively essential for directing artillery fire is an axiom among military men who have seen action in the sort of battles being fought on the western front.

"The magnificently obvious thing then is to knock out Germany's eyes by a thrust through the air. But my idea would be something vastly larger than a thrust. An inundation of aeroplanes would better express the idea in its magnitude.

"Sweep the Germans from the sky, blind the Prussian cannons and the time would be ripe to release an enormous flock of flying fighters to raid and destroy military camps, ammunition depots, military establishments of all kinds. The firing upon troops by machine guns from aeroplanes is becoming commoner and more accurate. Once given an upper hand the flying machines become frightful engines of destruction.

Safety in Numbers

"The greater aero fleet the safer it becomes to the aviator connected with it and the more deadly to the enemy against which it is sent. Six hundred million dollars looks like a lot of money. Considered in the terms of winning the war it is a positive bargain. England is spending $39,000,000 a day for her share in the war."



THE NEWS OF THE WEEK

Yale Aviators in Navy Begin Summer Training

Oyster Bay, N. Y.—Aerial Patrol Unit No. 1 of the Reserve Flying Corps of the Navy, and which consists almost exclusively of Yale graduates and undergraduates, began its summer fight training at its new training base on Huntington Bay.

This unit, organized largely by F. T. Davison, son of H. P. Davison, has been in Florida all winter. Most of its Yale men are athletes.

Army Aviation School News

1st Aviation School, Squadron, San Diego: Four hundred and nineteen flights were made during the week, with a duration total of 207 hrs. 41 min. In one day there were made 118 of these, with a duration of 53 hours. The student aviators receive instruction in aero motors from Mr. George Hallet; in motorcycle from Capt. Dargue, in construction and repair of aeroplanes from Capt. Jones and in radio from Lieut. Hoffman.

4th Aero Squadron, San Antonio: No flights were made during the week, the personnel being busy setting up machines, and in routine work.

1st Aero Squadron, Columbus, N. M.: The major portion of the week was spent in packing aeroplanes for shipment to San Antonio.

1st Aero Squadron, Columbus, N. M.: The completion of the work and shipment was made.

2nd Reserve Aero Squadron, Essington, Pa.: During the week one hundred and thirteen flights were made, with a duration total of 36 hrs. 13 min. Instructors accompanied pupils on all trips. The examining board is continually receiving applications for commissions for flying duty.

3rd or 4th Aviation School, Squadron, Ashburn, Ill: No classes were held during the week. Work attendant on the removal from Memphis and routine occupied the major portion of the time.

The Late Tom W. Benoist

The many friends of Tom W. Benoist, veteran air pilot and constructor, will learn of his death with profound grief. On June 14 Benoist was on his way to his office by trolley.

About 200 yards from his destination Benoist stuck his head out of one of the windows of the car. His forehead hit a telephone pole set close to the track. His skull was fractured in two places.

"Tom" was beloved by all who knew him for his frank expression, and for the constructive service that he had rendered the best interests of aeronautics in this country.

At the time of his death he was the head of the Benoist Aeroplane Co. of Sandusky, Ohio, and of the Benoist Aviation School. Both organizations were active in the upbuilding of Uncle Sam's air services.

Aeronautic Laboratory at University of California

Berkeley.—The regents of the University of California at a recent meeting passed plans calling for the erection of a special laboratory for students taking the special course in aeronautics. It is expected that the work will commence at once, and when the building is completed the latest equipment will be installed.

Belleville Air Site

Belleville. Ill.—Belleville has been selected as one of the sites for a United States Army aviation camp, according to a telegram received from Washington by the Board of Trade.

Earl Dodge Plans Big Flight

Newport, R. I.—W. Earl Dodge, who had an aviation camp here last summer, contemplates a flight from Plattsburg to Newport soon.

New Censor for War Department

Brig. Gen. Frank McIntyre, chief of the insular bureau of the War Department, has added the duty of military censor to his job, relieving Maj. Douglas McArthur, who is believed slated for an important assignment with U. S. troops in France. Gen. McIntyre has been in charge of censorship on the Mexican border and has served in a similar capacity in the Philippines.

110 Mechanics to Go to France

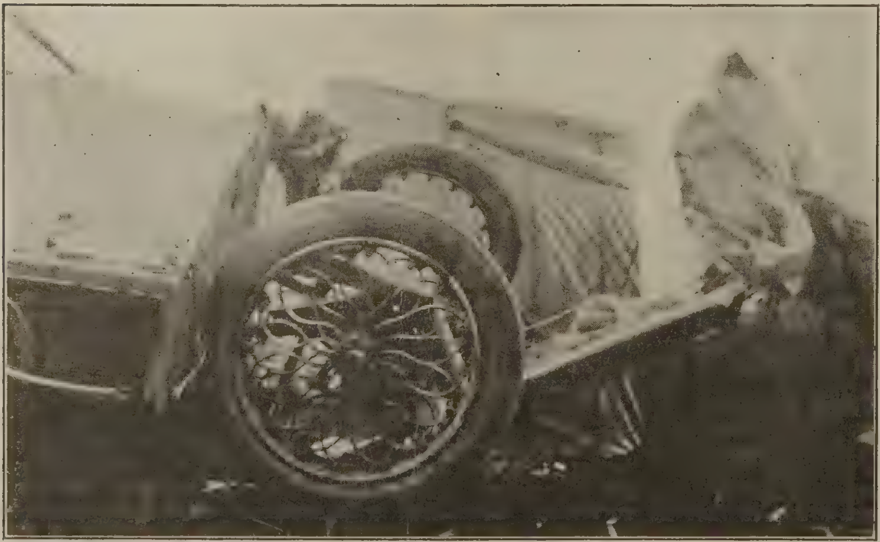
Washington.—The Government has selected 110 mechanics from automobile factories who will be sent to France to study the manufacture of aviation engines. Of these sixty-three are from Detroit and sixteen from Indianapolis. They will spend several months abroad and on their return will supervise aeroplane engine building here.

Aircraft Expert to Address S. A. E.

New York.—Additional interest is given the Washington meeting of the Society of Automotive Engineers, Monday and Tuesday, June 25 and 26, by securing Lieutenant Amaury de La Grange, of the French Aviation Corps, to present a paper on war aeroplanes, their different kinds and duties, for the afternoon of Tuesday, June 26. Lieutenant de La Grange has been sent to this country by the French Government to assist in developing aeroplanes, etc.

303 Reservations for S. A. E. Dinner

New York, June 12.—Reservations for the S. A. E. dinner to be held at the New Willard Hotel in Washington, June 26, have already reached a total of 303.



A demonstration of the efficiency of Ackerman aeroplane wheels, when a machine was completely wrecked, and not a single member of the wheels was broken.

Aviation Attracts 111 Plattsburgers

Plattsburg.—The aviation branch promises to be the most popular of all among the young men now training here for army officers. Hardly had announcement been made that camp members might apply for training in the flying corps than Lieut. Col. Wolf received more than a hundred applications. The following New Yorkers were in the list:

First Company—A. E. Garnsey, N. T. Kenyon, H. J. Fee, J. C. Millard, B. J. Colletti, F. N. Hourigan, C. Kingston.

Second Company—Belmont F. Beverly, Madison H. Lewis, A. L. Tait, G. A. Mulliser, H. F. Peto, W. Schoeler, C. P. Young, A. E. Peterson.

Third Company—Robert H. Reed, Joseph H. Bogart, David W. Howe, Peter H. McNulty, George R. White, Platt K. Wiggins.

Fourth Company—Morris Blumenthal, W. S. Callaghan, Elon Foster, John H. Gordon, Philip E. Hassinger, Salmon P. Hebard, Herbert Knaack, J. P. Perry, L. C. Quackenbush, Spencer C. Shotter, P. F. Walsh, Alexander Wiley, Wilfred E. Willis.

Fifth Company—T. S. Buchanan, K. Druffner, J. A. Eggleston, A. Lochhead, E. S. Tubbers, R. F. Ryan, J. A. Stratey.

Sixth Company—E. W. King, C. M. Cannon, Jr., Frank M. Brady, S. E. Grey, A. G. Haen, G. H. Fay, D. C. Statler, Thomas E. Stone, John M. Hayward, R. M. Herbert.

Seventh Company—Louis G. Bernheimer, Chester A. Rice, Roy M. Worley.

Eighth Company—H. S. Thompson, B. B. Elmer, G. J. Denike.

Ninth Company—J. O. Parisette, E. S. B. Walker.

Tenth Company—P. J. Wardell, J. C. Pemberton, P. D. Reid, M. Cobb, T. A. Simmons, S. W. Butler, W. L. Deetjen, C. T. McLean.

Eleventh Company—P. P. Morningstar, T. S. Lundgren, C. F. Frizzell, Jr., J. R. Dunlap, Jr., W. A. Hamilton, A. E. Kennedy, R. B. Sasseen, R. Phelan, J. A. Conway, W. W. Tait.

Twelfth Company—Second Lieut. Albert C. Rothwell, United States Cavalry; R. C. Bard, M. Squires, Herschel B. Benedict, Morland A. Horsefall, George E. Goldthwaite, Colin B. McClure, Allan T. Trumbull, William M. Lummis, William J. Cullen, John W. Scott, Paul J. Diemer.

Thirteenth Company—Stephen Bonsal, Jr., H. C. Dayton, J. W. Guard, E. N. Hilton, H. L. Roberts, L. Rothfield, E. A. Nostrand.

Fourteenth Company—F. D. Bell, H. S. Houghton, H. L. Woods, E. A. Craver, P. E. West, G. H. Barber, A. MacRossie, Jr.

Sixteenth Company—Vincent J. Meloy.

Seventeenth Company—Richard T. Beddow, H. T. Carstons, Joseph T. Flynn, H. J. Forshay, V. C. Jacobs, George A. Kent, Davis Petke.

Army and Navy Notes

Major Hiram Bingham, aviation section, Signal O. R. C., to active duty, report to Chief Signal Officer for duty in his office.

Captain Frank C. Page, Signal Officers' Reserve Corps, will proceed to Toronto, Canada, for temporary duty in connection with aviation.

Major Charles de F. Chandler, Signal Corps, will make not to exceed six visits to Hudson, N. Y., on official business pertaining to aeronautics.

Captain Robert H. Willis, Jr., junior military aviator, Signal Corps, to office of Chief Signal Officer of the Army.

Aeronautic Section 1st Batt. Naval Militia Active

The Aeronautic Division of the 1st Battalion Naval Militia, N. Y., is now in full operation at the Bay Shore Station which was established last summer.

Bay Shore, on the Great South Bay, was selected last year by Lieutenant Lee H. Harris, as being the most ideal location for a hydroaeroplane station within 100 miles of New York City, the headquarters of the 1st Battalion. Excellent work was done there last season with one plane owned by the Aeronautic Section. Four men were taught to fly by Lieut. Harris on week ends, the only time available in which to fly.

Realizing that the Section needed equipment, having only a tent hangar, Lieut. Harris and Ensign Charles E. Ruttan, now Lieut. (j. g.), set about raising a fund for erecting quarters for the men, mess hall and a permanent hangar.

Lieut. Harris and Lieut. Ruttan also availed themselves of the opportunity to go to the

Navy Aeronautic Station, Pensacola, Fla. to take a course of training during the winter to fit themselves to operate the Station this season even more successfully than last season. Upon returning from Pensacola, they set about raising a fund for the new equipment. Due to their efforts and co-operation of patriotic citizens, $12,000 has been raised. Two large bunk houses have been erected, a mess hall and galley capable of accommodating 60 men,. also built. An office and wireless building together with a 50-foot observation tower were other additions. Three splendid hangars were erected.

The Section has been recruited to a full Division of 46 men. Recently authorization has been received to recruit an additional Section composed of mechanics. At present the 1st Battalion Aeronautic Division is the foremost in the country and by far the best equipped.

The Aeronautic Section of the 2nd and 3rd Battalions are also stationed at Bay Shore. The entire camp is under the Navy Department and will soon be officially taken over by same.

Army and Navy News

Capt. John Dewar Irving, S.O.R.C., formerly professor of cartography at Yale, will command a unit of "skyographers" to be attached to the 1st Regiment of Engineers' Reserve in France. The duties of the members of this unit will be to analyze photographs taken from scout machines. It is said that the French have become so proficient in this new science that they have often worked out the actual number and character of troops stationed within the field of vision covered in one of the bird's-eye" photographs.

Reserve Officers for Aviators

Acting upon a letter of instruction from The Adjutant General, commanding officers of all Reserve Officers' training camps have selected from the students under them a number who will be ordered to the "ground schools" for instruction as aviators. It is planned to enroll about twenty-five men in each ground school on every Monday for the next five or six weeks. This will result in the addition of from 750 to 900 student aviators to the total of those who already have taken up the curriculum at these institutions. Eight of these so-called "ground schools" have been established, as follows:

Training Regiments.	Institution.
1st and 2d,	Massachusetts Institute of Technology.
3d and 4th,	Cornell University.
5th and 13th,	Princeton University.
6th and 7th,	Georgia "Tech" (Atlanta, Ga.)
8th and 9th,	Ohio State University.
10, 11th and 14th,	University of Illinois.
12th and 16th,	University of Texas.
16th,	University of California.

It was planned to have the first contingent arrive at the schools now in operation on June 11, and for the other contingents to follow at intervals of one week. The first units were made up as follows:

Provisional Training Regiment	No. of men	From	To
1st	10	Plattsburg	Mass. Tech.
2d	9	Plattsburg	Mass. Tech.
3d	12	Madison Barracks	Cornell
4th	11	Madison Barracks	Cornell
8th	11	Fort Ben. Harrison	Ohio State
9th	11	Fort Ben Harrison	Ohio State
10th	8	Fort Sheridan	Univ. Illinois
11th	8	Fort Sheridan	Univ. Illinois
14th	8	Fort Riley	Univ. Illinois
12th	12	Fort L. R. Roots	Uni. Texas
15th	13	Leon Springs	Univ. Texas

Schools for the candidates from the 5th, 6th, 7th, 13th and 16th Provisional Training Regiments will not be ready to receive the first quotas until June 18.

Camp commanders were instructed to furnish the men selected with transportation and subsistence to the school indicated. These men will be carried as members of their respective training companies, but will be recorded as "on detached service." Their service records will be sent to the commandant of the ground schools. The following memorandum from The Adjutant General gives further interesting details of this latest step to hasten the organization of an adequate air arm for the new Army:

"The matter of training men who are suitable as officers of the Aviation Section requires special and immediate attention. So-called 'ground schools' have been established at various points. Candidates at the ground schools are given a preliminary course of several weeks before they are sent to the proper camps for actual flying. In each of the ground schools about twenty-five men will be admitted every Monday to form a class for ground school instruction for five or six weeks. It is desired that the men sent to ground schools be taken, as far as practicable, for the present training camps. Their status as to pay, subsistence and travel allowance will be unchanged.

"The qualifications are as follows: The candidate should be naturally athletic and have a reputation for reliability, punctuality and honesty. He should have a cool head in emergencies, good eye for distance, keen ear for familiar sounds, steady hand and sound body with plenty of reserve; he should be quick-witted, highly intelligent and tractable. Immature, high-strung, over-confident, impatient candidates are not desired. The drafted men of the National Army will be men varying from twenty-one to thirty-one years of age, many of whom will be successful business men well established in life. It is believed that there are thousands of splendid young men now in the training camps whose only drawback is due to the fact that they are too youthful in appearance to be officers of a National Army composed of older men. It is precisely the keen young men of this class that make the best aviators.

"Applications for transfer from the training camps to the ground schools will be limited to candidates under twenty-five years of age. All approved applicants in each training regiment will be placed on a waiting list from which the weekly contingents will be taken. They will continue under instruction in present training camps until sent to ground schools. The list of approved applicants will be prepared and the total number will be reported to this office by telegraph as soon as practicable. Additions to the list may be made later in the discretion of the commanding officer, and promptly reported by telegraph to this office.

"Approved candidates who apply for the Aviation Section and who appear to be better suited for appointment as officers of that section than as Reserve officers of the line or Engineers will be carried on the Aviation Section waiting list and such candidates will not be included in the Field Artillery training bateries, or Engineer training companies, or Coast Artillery contingents sent elsewhere to special camps. They will remain at present camps until sent to ground schools. Candidates for transfer to the Aviation Section will undergo a special physical examination before being placed on the waiting list of approved applicants. This physical examination will be made and reported on A.G.O. Form No. 609."

Army Orders

Major Henry H. Arnold, S. C., to duty with Chief Signal Officer of Army. (June 5, War D.)

Capt. John W. Butts, S. C., report to commanding general, Eastern Department, for temporary duty as acting department aeronautical officer. (June 5, War D.)

Capt. Robert H. Willis, Jr., S. C., from duty in Southern Department to Washington for duty. (June 7, War D.)

Capt. Byron Q. Jones, S. C., will report to Joint Army and Navy Aircraft Board, Washington, for temporary duty. (June 6, War D.)

Capt. Herbert A. Dargue, S. C., relieved from details in Aviation Section of S. C., June 9. (June 9, War D.)

Maj. Henry B. Hersey, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding officer, United States Army Balloon School, Fort Omaha, Nebr., for duty.

The following-named officers of the Signal Officers' Reserve Corps are assigned to active duty, and will take stations as indicated below: Capt. Lawrence C. Mason, First Lieuts. Harlowe Hardinge, Frederick W. Wright, John P. Flood. Capt. Mason and First Lieuts. Hardinge and Flood will report in person to the commanding general, Eastern Department, for assignment to duty. First Lieut. Wright will report by telegraph to the commanding general, Eastern Department, for assignment to duty.

First Lieut. Paul V. Kane, Coast Artillery Corps, will proceed to Vancouver Barracks, Wash., and report in person to the commanding officer, with a view to his examination to determine his physical qualifications for detail in the Aviation Section of the Signal Corps, and upon the completion of the examination will return to his proper station.

Capt. William A. Larned, Signal Officers' Reserve Corps, is detailed as a member of the board of officers appointed in paragraph 47, Special Orders, No. 246, October 20, 1916, War Department.

Marmon Ordered to France. Recently Appointed Aircraft Engineering Engineer to Study French Aviation Engines

Washington—Howard C. Marmon, of Nordyke & Marmon, Indianapolis, recently appointed aircraft engineering engineer of the Aircraft Production Board, has been ordered to France and will depart in the near future to inspect aeroplanes in use on the French front with a view to standardizing and co-ordinating the engines of American flyers with those in the French machines.

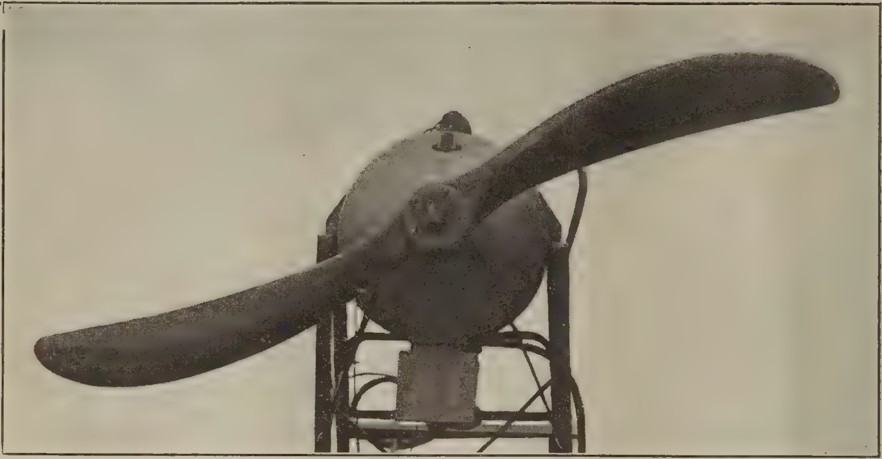
He will be accompanied by a large force of workmen and motor experts. It is not expected that Mr. Marmon will remain in France very long. He probably will return at about the time American manufacturers are ready to begin the manufacture of aeroplanes in large numbers. It is understood from reliable sources that the Government plans to place at least 17,500 flyers on the western front inside of 3 years.

Slade Joins Aircraft Board

Washington, June 13.—A. J. Slade, consulting engineer, of New York, has been placed in charge of transportation for the Aircraft Production Board. Slade will probably be made a captain of transportation and be put at the head of one of the four departments. He enters into the duties of this position immediately.

Mr. Slade has been regarded as one of the few authorities on electric commercial vehicles and electric cars generally and has been chairman of the electric vehicle division of the S. A. E. standards committee for several years. Having studied the dollars and cents aspect of road transportation very closely in connection with his consulting work, he should be eminently well fitted for his new appointment.

A Burgess training seaplane in course of construction.



Showing how the Cleveland Aeromotor permits streamlining of the fuselage.

THE CLEVELAND AERO MOTOR

By G. DOUGLAS WARDROP

ONE of the most interesting aviation motors that has come to our attention for a considerable period is the power plant which has recently undergone tests in Cleveland, the product of the Cleveland Aero Motor Company.

This engine is of the four cycle type, having its cylinders so timed that explosions occur regularly in sequence right around the ring of cylinders. This timing and the ratio of gearing to the main shaft to the propeller gives power impulses every sixty degrees of rotation. This construction, it has been found gives to the propeller an exceedingly even and easy rate of rotation, a thing highly desired from every standpoint. Ignition is supplied from two high tension magnetos or by battery as may be desired. A conventional type of carburetor is used and the speed range controlled by throttle.

In laying out the power plant the designers have kept in mind the desirability of building a motor which is compact, light, powerful, and which in building those parts ordinarily subject to an adjustment may be brought within vision of the operator in his piloting position. A glance at the illustrations of the experimental machine will show in a general way how this has been accomplished.

General Design

In detail the construction of this engine consists essentially of the following parts: a main shaft, central lookout within the crank casings which carries, what might be called a "bull gear"; the propeller, through which the power is transmitted. The cylinders, six in number in this particular machine, are disposed in a position such that their axes lay parallel with the center line of the main shaft and attached to what might be termed one end of the crankcase. Each cylinder transmits its power to the single throw crank to which is affixed a bevel opinion meshing with the "bull gear" on the main shaft. In this particular engine the speed ratio of the crank shaft pinion to the "bull gear" is 2 to 1. This arrangement makes possible delivery of the power to the propeller at a low speed and makes possible also the direct attachment of valve operating mechanism to the main shaft without intermediate gearing.

A close study of the power plant brings out the fact that it particularly lends itself to streamlining in fuselage design, and furthermore the operating mechanism is so located at one end in such a way that it can immediately be explored for repair or adjustment without the necessity of climbing over the machine to do it.

From the stand point of power the engine offers many interesting possibilities. It should be possible with this construction, because of the reduced speed of the propeller, to deliver a greatly increased amount of power, for a given size cylinder, than can be delivered from other types of motors without reduction types of gearing. It will be noted in this machine there is no separate reduction gear and that this speed reduction is impracticable in the fundamental design. This not only reduces weight but eliminates time in production and more or less difficulty in actual operation.

It has been the intention of the designers to so arrange the parts of the motor as to eliminate every possible item in its construction which is not absolutely essential to its operation. Cams which operate the valves are placed directly on the main shaft and operate on the valve stems through exceedingly simple valve lifters. This makes possible the use of valve springs whose weight is approximately only sufficient to make the valves close without the lifters which may be free from the cam. In other words, there is no intermediate mechanism which the spring is to handle in the closing of the valve.

Nothing radical is attempted in the way of cylinder design except to make all parts of it conform to the thought of simplicity, light weight and high power. Even the double ignition system which is used is actuated without complications and is so situated as to be at all times perfectly accessible. There is but one oil pump and one water pump.

Power Rating

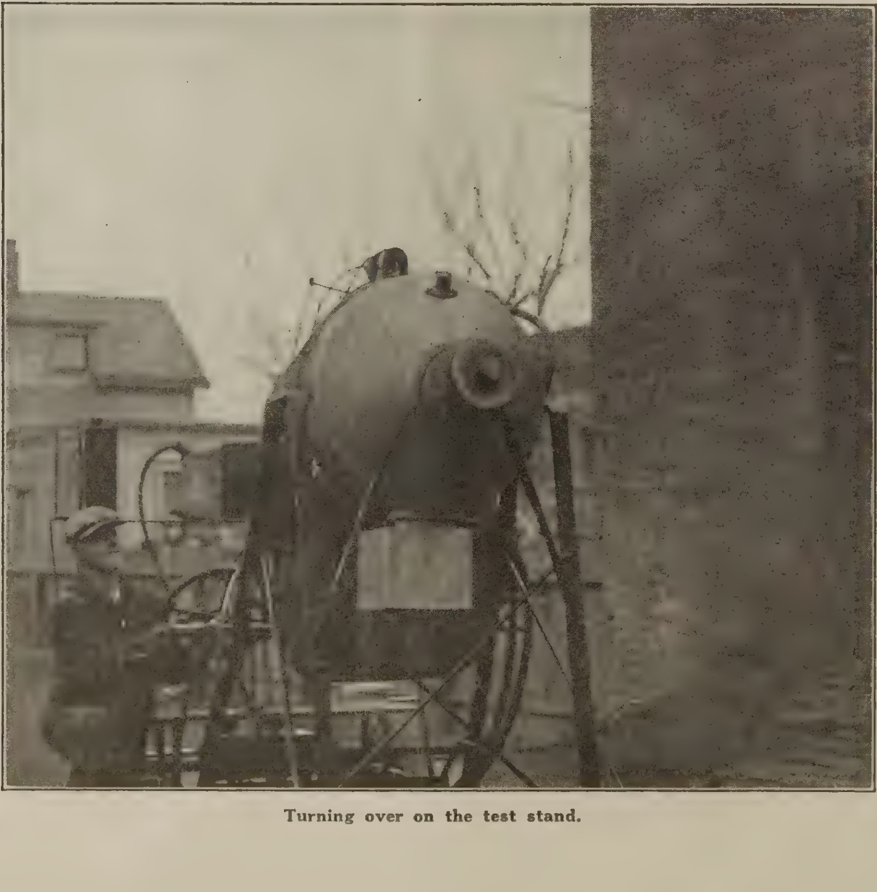
Tests of the motor would indicate that a rating of 100 h.p. at fourteen hundred r.p.m. is a conservative one. In order to obtain this power, and for a reasonable factor of reserve power, cylinders are 4" by 6". The compactness of the motor lends itself to light weight per h.p., and it is figured that this will be somewhere about three pounds.

Dimensions

The extreme outside diameter of the crankcase is 23". The length from inisde of the propeller hub to the cylinder head is thirty inches with a connecting rod length equal to four times the throw of the crankshaft.

Materials

The materials entering into the construction of this motor are of the highest grade. Driving gears are of chrome nickel steel of approximately the following ingredients: carbon .15 to .25, chromeum 1.20, manganeze .75, sulphur .02, silicon .12, phos. .02. The gears are case hardened to the depth of approximately one sixteenth of an inch, double heat treated and drawn to the proper degree of hardness. This steel gives physical strength as follows: tensil strength about 210,000 pounds; elastic limit about 180,000 pounds.



Turning over on the test stand.

For crankshafts a similar steel is used and treated so that its tensil strength becomes 245,000 pounds per inch.

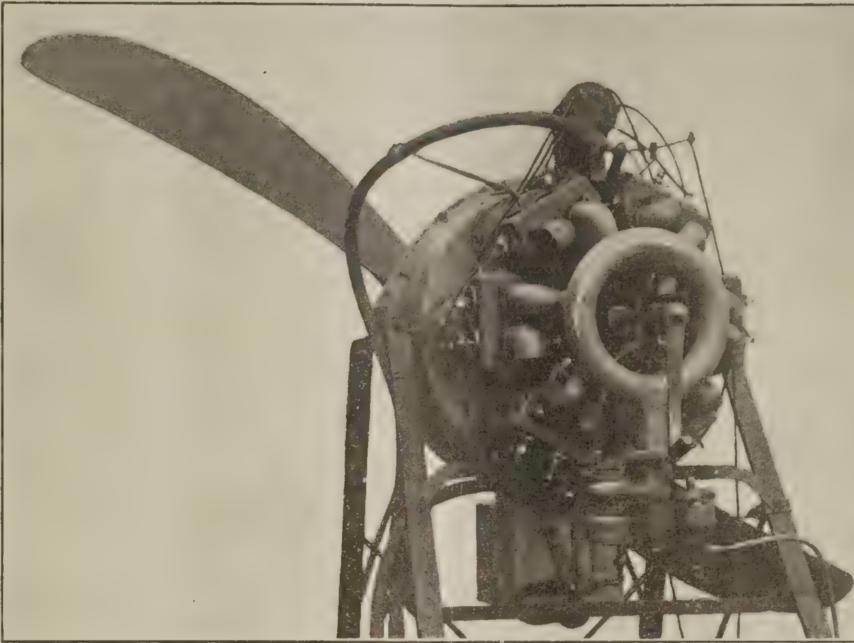
A feature worthy of note is that the main bearing is housed in such a way that the pressure due to the explosion within the cylinder is taken up on bolts running through the base from the cylinder head clear to the main bearing caps and properly fastened. Cylinders will be made of either cast iron or steel. The pistons are aluminum alloy; piston rings are single piece type to hold all pressure developed in the cylinder. Valves are in nickel steel, heat treated.

Cooling System

Cooling of cylinders is had through the use of water delivered to them through a gear pump of ample dimension, from them to the conventional type of radiator. The arrangement of this water system is such that it is impossible to form stream pockets in any part of the motor.

Lubrication

The lubricating system is entirely automatic and consists of a reservoir from which oil is pumped on the "bull gear" in such a way that it is thrown on the various crank shafts and from there into the various cylinders for their lubrication. The cam box is flooded with oil which overflows into the reservoir.



Showing the arrangement of the cylinders of the Cleveland Aeromotor.

AIRCRAFT MANUFACTURERS' ASSOCIATION MEETS

A great deal of business was transacted at the meeting of the Aircraft Manufacturers' Association, in the Astor Building, on Wednesday, June 13. All the members of the Association were present. Mr. Orville Wright was elected honorary member, and Mr. F. P. Whitaker, of the Hall-Scott Motor Car Company was made a representative member.

A detailed discussion of quantity production was held. Preliminary arrangements to meet all the possible demands of the United States Government, for more machines of all types are complete and the manufacturers are ready to expand the industry so that the largest possible demands may be met in a substantial manner.

A plan to establish an experimental station to centralize and control experimental work and to keep it separate from the regular production work was discussed. The engineering staff is to report further on the feasibility of this proposal.

A movement to get in close touch with the Aviation Production Board and the Legislative and Administrative authorities in Washington, with the object of conserving the supply of linen and lumber for the production of aircraft was set on foot.

The Standardization Committee has under consideration the following aeroplane parts:

(1) Turnbuckles.
(2) Eye Bolts.
(3) Shackles.
(4) Bolts and Nuts.
(5) Propeller Hubs.
(6) Wire and Cable Ends.
(7) Special Light Pipe Fittings.
(8) Flanges and Filler Caps for Gasoline and Oil Tanks.
(9) Wheels and Hubs.
(10) Control Pulleys.
(11) Control Arms.
(12) Location of Controls in Pit.
(13) Seats.
(14) Strut Sockets.
(15) Strut Ends.
(16) Motor Supports on Crankcase.

The entire technical force of the Aircraft Manufacturers' Association has been placed at the service of the committee in determining standardization.

The Materials Committee reported that the industry had on hand 4,000,000 feet of air dried spruce suitable for aeroplane construction and 300,000 yards of linen for wing and fuselage covering or sufficient for 2,500 machines.

The Publicity Committee reported that many erroneous statements regarding the aeronautic industry had been made in the press and that the purpose of this Committee was to refute such stories and supply accurate information.

A communication from the Society of British Aircraft Constructors expressed the desire to have close co-operation with the Aircraft Manufacturing Association of America. Before the was the British Government gave little support to the aircraft industry but now over £75,000,000 were invested in the British manufacturing while the United States without the intensive impetus of three years of war, now has $20,000,000 invested in the industry. The Secretary was instructed to continue to maintain the closest co-operation with the S. B. A. S.

At the end of the meeting the Secretary, Mr. A. L. Williams, gave out the following statement on behalf of the Society:

"The Aircraft Industry is Prepared"

The aircraft industry is in a position to meet the most liberal developments that can occur in the field of aviation. Our factories are equipped and tooled up and employ about ten thousand men that are capable of turning out any quantity of at least five different types of aeroplanes and seaplanes, to meet any requirements that foreign experience has indicated during the past two years as being desirable. Many factories are now working on the relatively small orders that have been placed by this Government and are anxiously awaiting the word to expand to a greater degree.

Lord Kitchener in the early part of the war, placed with the British Aircraft Constructors, orders that were far beyond their ability to produce, and as a consequence, the industry had enough work ahead of it to enable the constructors to make a big jump.

In America, the capacity of the industry is far in advance of the orders that have been placed with it and, type for type, we can equal the foreign built machines, although it has had the advantage of three years intensive development, backed up by an exceedingly liberal encouragement from the Government.

The American industry, given the same amount of money and the same degree of encouragement, has the ability to overshadow even this great achievement far beyond the highest expectations.

American ingenuity and commercial enterprise, along practical lines, is bound to win out. And with the assurance of continued orders for a definite period, the individual manufacturers that now are representative of a well established industry, will give a most excellent account of themeslves.

It is, however, essential that for the industry to map out a definite plan of action to meet the new conditions, the fullest possible support be given in every direction.

Those present were: Pres. Frank H. Russell, Burgess Company, Marblehead, Mass.; Vice-Pres. Albert A. Flint, L. W. F. Engineering Co., College Point, N. Y.; Treas. Inglis M. Uppercu, Aeromarine Plane & Motor Co., New York City; Sec. B. L. Williams; Mr. T. Tarbox, Curtiss Company, Buffalo, N. Y.; Mr. H. B. Mingle, Standard Aero Corporation, Plainfield, N. J.; Mr. Benj. Foss, B. F. Sturtevant Company, Boston, Mass.; Mr. F. L. Morse, Thomas-Morse Aircraft Co., Ithaca, N. Y.

Army Orders

June 8.—The following-named officers will report in person to Col. Ira A. Haynes, Coast Artillery Corps, Detached Officers' List, president of the examining board at Washington, D. C., appointed February 3, 1917, at such time as they may be required by the board, for examination to determine their fitness for promotion.

First Lieut. George H. Brett, Cavalry (captain, Aviation Section, Signal Corps).

First Lieut. Henry W. Harms, Cavalry (captain, Aviation Section, Signal Corps).

Capt. Edward B. Craft and First Lieut. Robert A. Jones, Signal Officers' Reserve Corps, are assigned to active duty and will report in person to Maj. Frank B. Jewett, Signal Officers' Reserve Corps, New York, N. Y., for duty.

First Lieut. Paul D. Miller, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to Col. Edgar Russel, Signal Corps, Washington, D. C., for duty.

Capt. Shepler W. Fitzgerald, junior military aviator, Signal Corps, will make not to exceed three visits from the Signal Corps Aviation School, Mineola, Long Island, N. Y., to Gloucester, Mass., for temporary duty in connection with the aviation service of the Army and upon completion thereof will return to his proper station after each visit.

Under the provisions of section 55, act of Congress approved June 3, 1916, and the act of Congress making appropriation for the expenses of the Signal Service of the Army, approved August 29, 1916, the action of the Chief Signal Officer of the Army in placing the following sergeants on active duty in the Aviation Section of the Signal Enlisted Reserve Corps with station at the Signal Corps Aviation School, at Memphis, Tenn., taking effect May 18, 1917, is confirmed: William F. Goulding, Louis L. Carruthers, Frank O. D. Hunter.

June 11—First Lieut. Howard P. Culver, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Fort Sam Houston, Tex., and report in person to the commanding general, Southern Department, for assignment to duty.

Capt. William A. Larned, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the Chief Signal Officer of the Army for assignment to duty.

Capt. Ralph Royce, junior military aviator, Signal Corps, is relieved from duty at the Signal Corps Aviation School, Chicago, Ill., and will proceed to Washington, D. C., and report in person to the Chief Signal Officer of the Army for temporary duty. The travel directed is necessary in the military service.

SOME NEW GERMAN AEROPLANES

THE accompanying illustrations and information are compiled from various German sources, and the interesting pictures must make amends for the scarce specifications available, but themselves render chances of studying the latest development of German war aviation.

The Twin A.E.G.

One of Germany's most employed battleplanes is the A.E.G. twin-engined and three-seated tractor biplane of the aircraft department of the largest German concern: "Allgemeine Elektricitäts Gesellschaft" (General Electric Co.). The motors are carried on a front four-struts pyramid, and a back set V of two struts without any support to the top plane, above the landing chassis consisting of two pairs of wheels, each carried by two V struts.

The cabane, consisting of three pairs of V struts, the front one forward being inclined forward. The bomb dropping device is below the passenger seats, and the big feeding tank in the upper plane is clearly visible.

The shape of the radiators and of the rudder are noteworthy.

The L.V.G.

The L.V.G. biplane is of usual general appearance except that the feeding petrol tank has been transferred to the left, just below the upper plane, and its general place has been taken by the radiator, of plane shape, with a small water tank, built and working as a small stabilizing fin.

The Roland Fighter

The Roland is a typical modern German scout, being the latest sort of two-seater with a direct strut influence of the Curtiss scouts. The thickness of the cross wire indicates likely that the Germans now streamline the two bracing cables with intermediate strips of wood.

The Roland biplane possesses the typical "whale" characteristics of that type, which has, with the corresponding Albatros and Halberstadt models, been named the "German Spads."

The gun turret and the seat of the passenger is of the general type, the single window at the passenger's seat and the double one of the pilot's are clearly visible. The landing chassis is equipped with a claw brake. The engine is a 160-h.p. Mercédès motor, and the branched cooling tubes on the upper plane are noteworthy, though their object at much head resistance is not evident from the illustration.

The Pfalz Monoplane

The Morane type monoplane is a product of the Pfalz aircraft works in Speier on the Rhine, employing a 100-h.p. Mercédès stationary motor with a somewhat streamlined front elevation.

A Pfalz biplane, much like the Ago pusher with the Champel type nacelle, was used on German side in the East African campaign, and the Pfalz monoplanes, either with rotary or stationary engines, are very similar to the Fokker, from which they differ in their armament of two fixed guns, mounted on each side of the pilot and firing through the propeller.

The Gotha Biplane

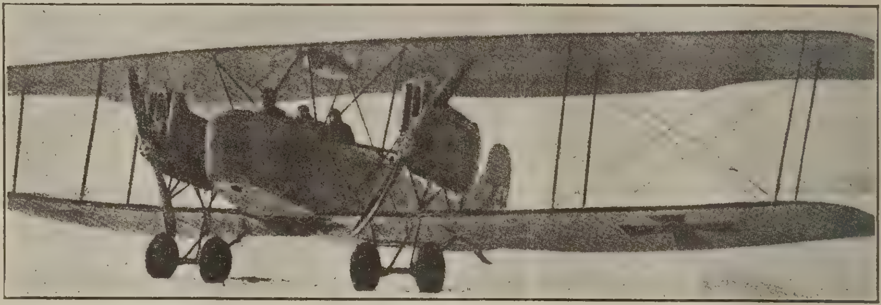
The big, twin-engined Gotha biplane was taken over the theatre of war from a higher flying aeroplane. The battleplane is a pusher, as indicated by the cutting of the planes, and the front part of the right engine looks like the ventilator cowl usually seen on a Renault motor.

The seats of the pilot and his observer are evident in front of the planes, but it is not ascertainable whether there is a third seat at the back edge of the planes. A big petrol tank is visible in the upper plane.

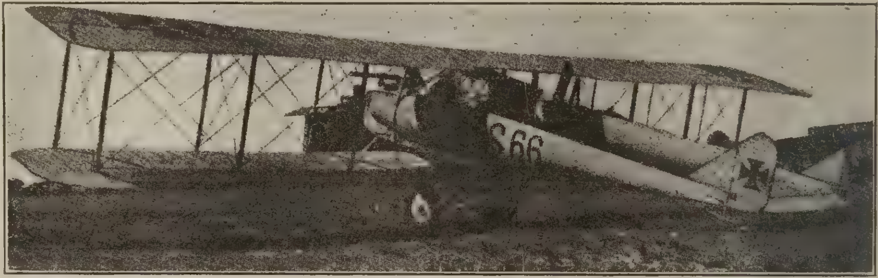
The Ago Two-Tails

The twin-bodied pusher biplane marked S.66 is a product of the Ago works, which are managed by a lady director, Frau Woerner. The observer sits in front in the boat-shaped united nacelle of the bodies, managing the clear range gun. The single engine is a 150-h.p. Benz motor. The landing chassis is equipped with a claw brake and two skids, supported by struts from the front part of the nacelle.

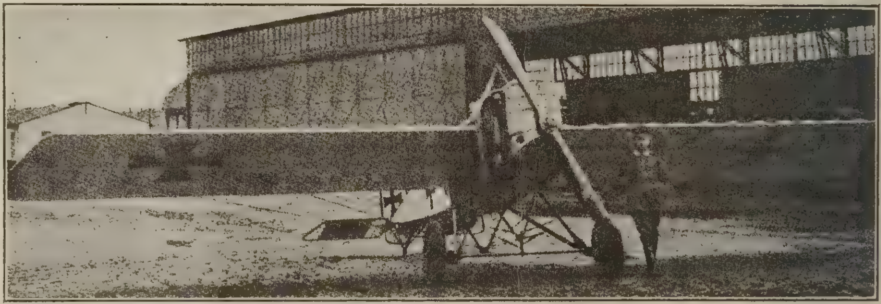
The surroundings indicate that the picture was taken at the Johannisthal aerodrome, and with its Maurice Farman rudders this Ago biplane looks much like the one that artists produced about a year ago to general verbal description, as none were brought down, of a three-engined Aviatik aircraft.



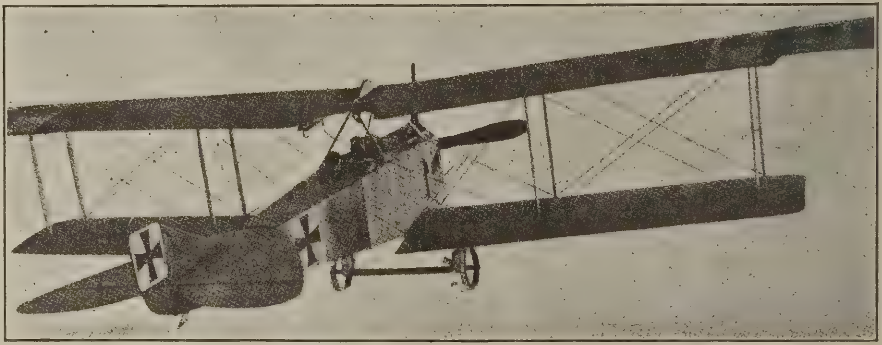
A. E. G. biplane, a twin-motored bomb-dropping machine.



"Two Tails," twin fuselage single motored AGO biplane.



The PFALZ monoplane with a 100 H.P. Mercedes motor.



Rear view of the latest L. V. G. biplane.

"Aircraft in the German War"

Unfortunately this book was written shortly after the great war broke out, and by this time many types of machines are obsolete. The same thing is true of the various accomplishments of the aeroplanes and hydroaeroplanes. The chapter on the work of the R. A. F., and the functions of Zeppelins forms a clear exposition of a much discussed question as also does the explanation of the principles of International law, as they are affected by raids over defenceless towns.

This work will be invaluable as a record of what happened during the first six months of the war with regard to the offensive campaigns of the aerial branch of the German advance in Belgium and northern France, and the first raids over England. It is an excellent record also of the first measures of defence taken by the Allies to meet the German Zeppelins. Fortunately many of the things foreseen in the methods of aerial attack and defence have come to pass since this work was written and the Zeppelin raids at least seem to have been stopped.

"Aircraft in the German war" is most comprehensive in the field that it covers treating as it does the aerial service of the Allies and the Central Powers at the same time. As a first chapter of the part aircraft played in the great war this book is very serviceable.

SWEPT BACK WINGS[1]

By H. E. ROSSELL and C. L. BRAND

Asst. Naval Constructors, U. S. Navy

PART I.—LIFT, DRIFT, AND CENTER OF PRESSURE

To determine the effect on the aerodynamical properties of a wing of sweeping back the wing tips, as in the so-called German "Pfeil" aeroplanes, a series of tests was made on the model described as R. A. F. 6. The right and left halves of the wing were swept back 10, 20, and 30 degrees to the normal position as shown in figure 17.

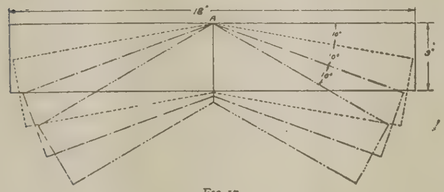


FIG. 17

The first part of the investigation deals with the variation in lift and resistance coefficients, and the movement of the center of pressure for the different models as the angle of incidence changes. The wind velocity of 29.85 miles per hour of standard air remains in the plane of symmetry of the wing.

The curves of the above characteristics for the four wings are given in figures 18, 19, 20.

The ratios of lift to resistance coefficients are given in figure 21.

The following key will serve to identify the wings:

Wing	Swept Back
I................	0 degrees
II................	10 degrees
III................	20 degrees
IV................	30 degrees

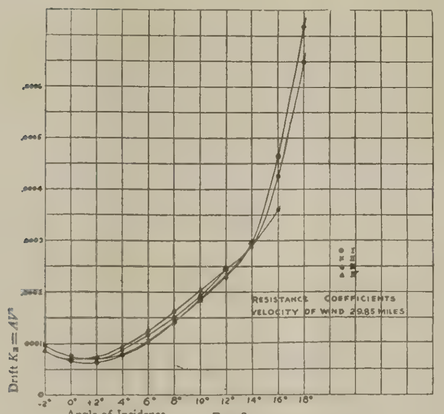


FIG. 18

Coefficients are given as pounds force per square foot per mile per hour velocity.

It appears that a sweep back of 10 degrees and 20 degrees is of no disadvantage from considerations of lift and resistance. There is, however, no gain. For a sweep back of 30 degrees, the lift coefficient is diminished and the ratio of lift to resistance is seriously reduced. What advantages there may be as regards lateral stability for wings swept back 30 degrees are therefore paid for by a considerable loss in effectiveness. The ratio $\frac{K_y}{K_x}$ of 16.5 for the normal wing and for No. II is reduced to 12.9 for No. IV.

The center of pressure motion is shown by the curves of figure 20, in which it appears that the motion is similar for all the wings tested.

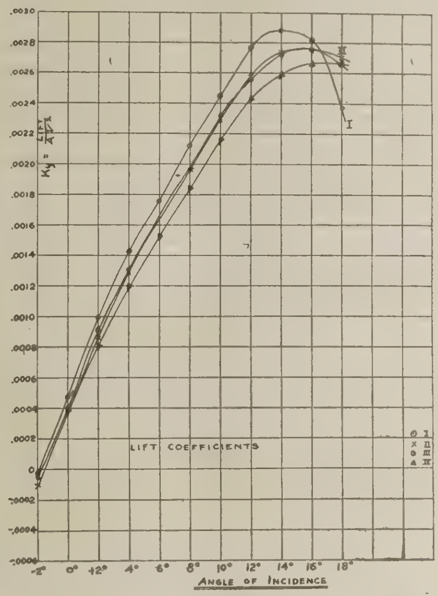


FIG. 19

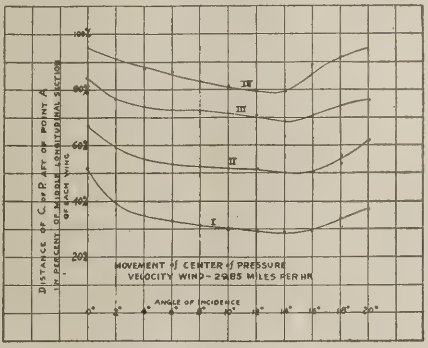


FIG. 20.

The center of pressure motion gives rise to the same degree of longitudinal instability. The center of pressure is referred to the forward point of the middle longitudinal section of each wing, and it appears that for a given angle of incidence the center of pressure is thrown to the rear by about two-tenths of the chord for a sweep back of 10 degrees, and four-tenths of the chord for a sweep back of 20 degrees. The center of gravity of an aeroplane will, therefore, have to be placed farther to the rear if swept back wings are used.

PART II.—ROLLING, PITCHING, AND YAWING MOMENTS

The object of this test is to determine the effect on stability of sweeping the wing back to various angles, as described in Part I of this report.

The wing uncut was first mounted horizontally on the balance, and forces and moments as enumerated below were measured for angles of yaw of 0, 5, 10, 15, 20, 25 and 30 degrees in both directions for each of the following angles of incidence: 0, 3, 6, and 9 degrees. The velocity of wind was kept constant at 29.85 miles per hour. The same measurements were made with wing models swept back to 10, 20, and 30 degrees. The method of manipulating the balance to make these measurements is given in detail in Report 68, Technical Report of the Advisory Committee on Aeronautics, 1912-13 (London).

It is convenient to calculate the forces and moments about moving axes fixed relative to the wing. The axes are lettered *OX*, *OY* and *OZ*. In figures 22 and 23, point *O* we have located at the middle of the leading edge of each wing. *OX* is the fore and aft, *OY* the transverse, and *OZ* the normal axis of the wing. When the wing has zero incidence and yaw, the position of the axes is shown in figure 22 by

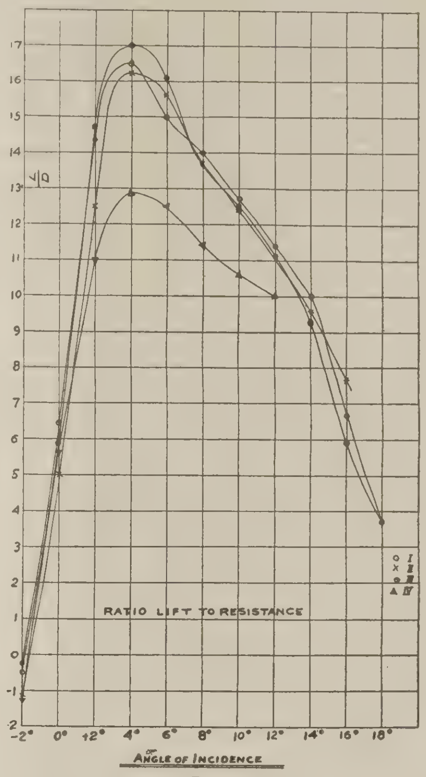


FIG. 21.

OX_2, OY_2, and OZ_2. Now suppose the wing to be turned about OZ_2 through a positive angle of yaw ψ. Then the axes will be in the position, OX_3, OY, and OZ_2 Now if the wing is given

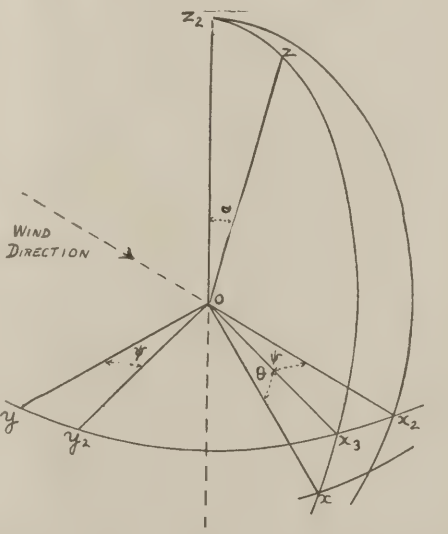


FIG. 22.

an angle of incidence of θ about *OY*, the axes will swing into the positions *OX*, *OY*, *OZ*.

In making the calculations it is easier first to refer the forces and moments to a set of axes parallel to *OX*, *OY*, and *OZ*, which we have designated as *O'X'*, *O'Y'*, and *O'Z'*. The origin of these axes is coincident with the origin of axes about which rolling and pitching moments were measured.

Forces along axes *OX*, *OY*, *OZ* are called *AX*, *AY*, *AZ*; *A* being the area of model in square feet; and moments about these axes are called *L*, *M*, and *N*. Forces along and moments ᵛ the position of the axes

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[1] Abstract from a research submitted for the degree of Master of Science in the Department of Naval Architecture, at the Massachusetts Institute of Technology.

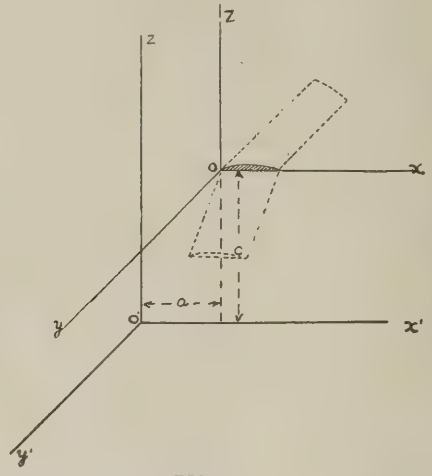


FIG. 23.

about axes $O'X'$, $O'Y'$, and $O'Z'$ are represented in the same way, *i. e.*, AX', AY', etc.

The notation used for the measured forces and moments is as follows:

(1) Force along $O'Z_2 = V_t$. Measured on vertical force lever.

(2) Moment about $O'Z_2' = M_z$. Measured on torsion wire.

(3) Moment about $O'Y' = V_p$. Measured on vertical force lever.

(4) Moment about $O'X_3' = V_r$. Measured on vertical force lever.

(5) Moment about an axis parallel to $O'Y_2'$ and distant l below it $= M_d$. Measured on drift beam.

(6) Moment about an axis parallel to $O'X_2'$ and distant l below it $= M_c$. Measured on cross wind beam.

The forces and moments desired can then be calculated by the following equations:

$$L' = V_r \cos \theta — M_2 \sin \theta.$$

$$M' = V_p.$$

$$N = V_r \sin \theta + M_z \cos \theta.$$

$$AX = —V_t \sin \theta + \frac{(M_d \cos \phi — M_c \sin \phi — V_p) \cos \theta}{l}.$$

$$AY = \frac{V_r — M_c \cos \phi — M_d \sin \phi}{l}.$$

$$AZ = V_t \cos \theta + \frac{(M_d \cos \phi — M_c \sin \phi — V_p) \sin \theta}{l}.$$

$$L = L' + cAY.$$

$$M = M' — cX + aAZ.$$

$$N = N' — aAY.$$

Where a and c are the X and Z coordinates of the origin O taken from axes O^1X', O^1 and $O'Z'$.

Figures 24 to 31 show the forces X, Y, Z, and moments L, M, N plotted on angles of yaw as abscissæ for constant angles of incidence of 0, 3, 6, and 9 degrees. At any incidence the chord of the wing at its center coincides with the OX axis. In figure 32, X, Z, and M are plotted with angles of incidence as abscissæ and with 0 degrees yaw.

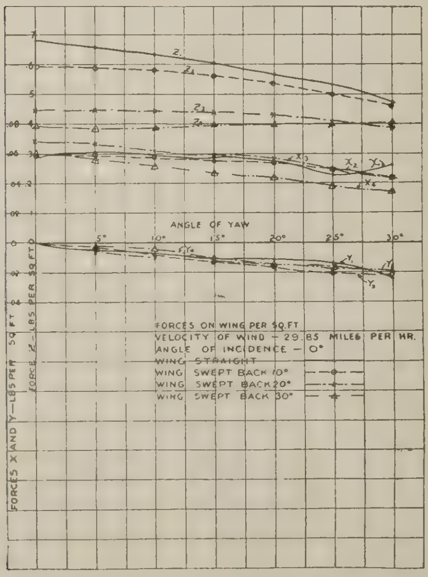


FIG. 24.

The notation used is as follows:

Subscript 1—wing straight.

Subscript 2—wing swept back 10 degrees.

Subscript 3—wing swept back 20 degrees.

Subscript 4—wing swept back 30 degrees.

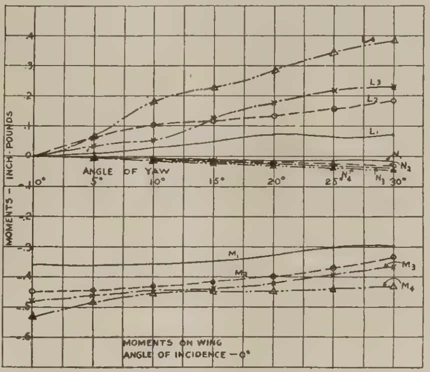


FIG. 25.

For the application of the theory of the dynamical stability of aeroplanes, reference should be made to the excellent papers by Mr. L. Bairstow.

It is shown that for longitudinal stability the rate of change of the quantities X, Z, and M with angle of incidence determines the so-called resistance derivatives. It appears from the observations made on swept back wings that there is no appreciable change in the slope of curves of X, Z, and M plotted on angle of incidence for the different wings. Figure 32 shows some difference in form for curves M plotted on angle of incidence. It must be borne in mind, however, that the origin of these curves is at a greater distance from the center of pressure the farther the wing is swept back. A better idea of the variation in pitching moment with change in incidence can be obtained by plotting the curves with the estimated center of gravity of the machine as the origin. Figure 20, Part I of this report, shows the movements of the centers of pressure to be similar for all wings. The conclusion is that sweeping back wings has no effect on the corresponding derivatives of X, Z, and M, and consequently no effect on longitudinal stability. It is of course to be expected that swept back wings may slightly increase the radius of gyration for pitching and so affect the motion indirectly. Aerodynamically, however, no advantage is to be expected.

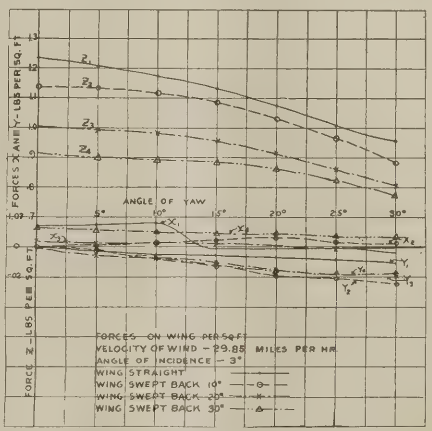


FIG. 26.

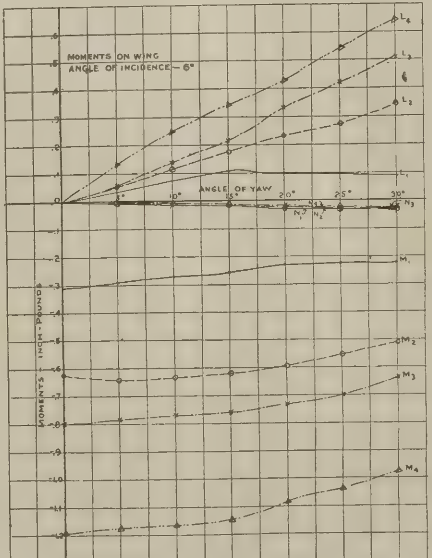


FIG. 27

For lateral stability the derivatives affected by the wings are the rate of change of Y, L, and N with angle of yaw. From considerations of symmetry, Y, L, and N are not affected by angles of roll.

The curves of lateral force Y give evidence of difficulties in experimentation. The force Y on the model was in the neighborhood of 0.004 pounds. It does not appear that there is any consistent change in Y due to sweep back which can be brought out. In any case the force Y is so small that small changes would be of no interest.

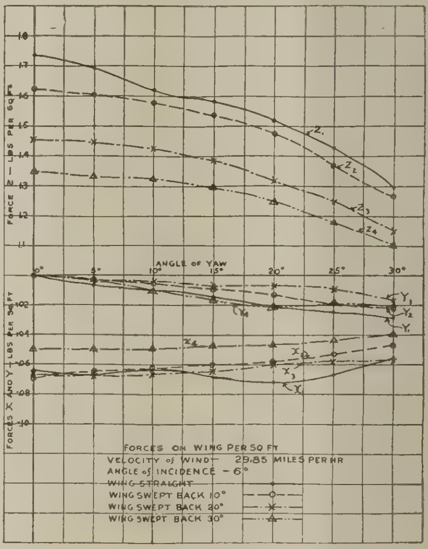


FIG. 28.

The curves of yawing moment N with angle of yaw show an extremely small moment, which was obviously impossible to measure with sufficient precision to detect changes between the various wings. Indeed, as in the case of lateral force Y, the effect of changes in N produced by the wing is of no account.

On the other hand, L, the rolling moment produced as the wing is yawed out of its course, is large and of the greatest importance, as it interconnects directional and lateral stability. For a normal wing flying at any reasonable incidence a deviation from the course causes a small rolling moment tending to bank the machine in a manner appropriate to making the turn. The couple may be called a "natural banking" moment. This "natural banking" moment is increased nearly 100 per cent if the wing has a sweep back of but 10 degrees. The moment for a sweep back of 20 degrees is still greater.

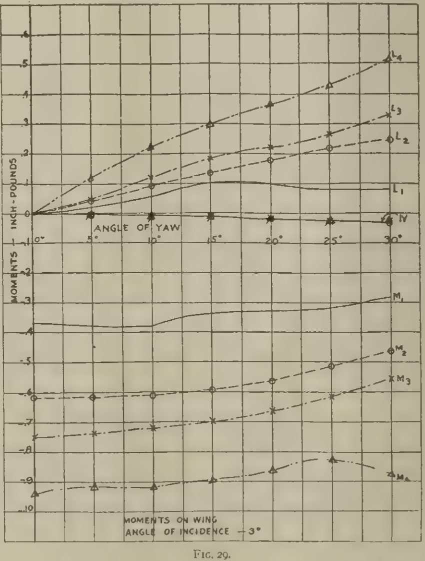


FIG. 29.

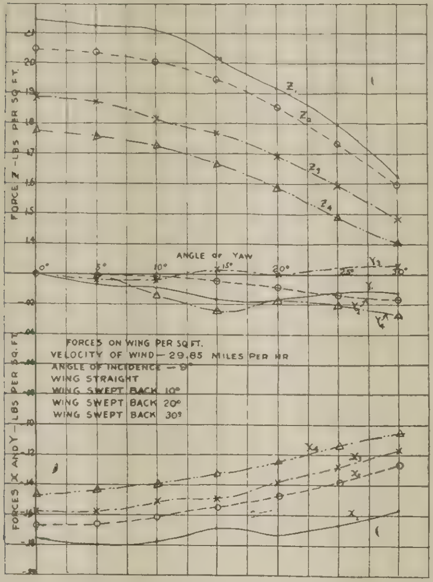


Fig. 30.

In view of the structural difficulties in making strongly swept back wings, and the loss of effectiveness as carrying surface for a sweep of more than 20 degrees, one would conclude that if any sweep back be used, about 10 or 15 degrees is sufficient.

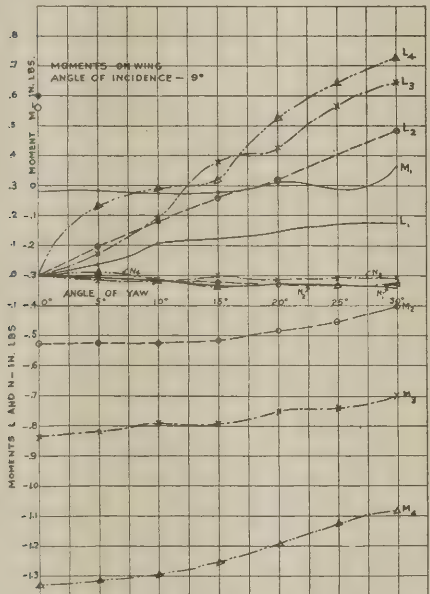


Fig. 31.

The banking moment is appreciable on the aeroplane, as may be shown by the following calculation:

Incidence 6 degrees, yaw 15 degrees, sweep 10 degrees, moment L_1 on model .18 pound-inch at 29.85 M. P. H., moment on biplane of 400 square foot area L_2 at 60 M. P. H.

$$\frac{0.18}{12} \times 2 \left(\frac{200}{.364}\right)^{1.5} \times \left(\frac{60}{29.85}\right)^{2} = 1{,}560 \text{ pound-feet}$$

The greatest value of swept back wings is to be found on a side slip. If by any accidental cause an aeroplane with swept back wings is heeled over, it begins to side slip toward the low side. The apparent wind is no longer from dead ahead, but is a little to one side as compounded from the velocity of side slip and velocity of advance. The effect is the same as if the machine had yawed from its course, and with swept back wings the "natural banking" moment becomes a much greater righting moment than with straight wings. The machine then has a degree of lateral stability.

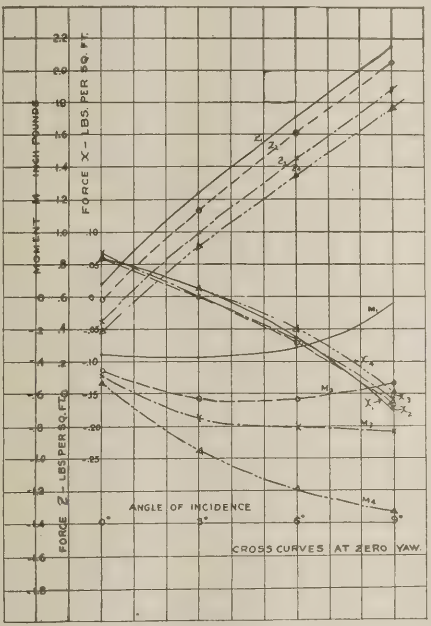


Fig. 32

For lateral stability, swept back wings can be made to give a righting couple without introducing a lateral force or yawing couple. The absence of a yawing couple and lateral force is of advantage if the machine is to be kept on its course as it rolls.

Naturally, it is purely a matter of judgment whether too large a righting couple is disadvantageous. In a gusty wind, a machine with swept back wings will tend to roll as side gusts strike it. This may be uncomfortable for the pilot, but if his aileron control be powerful he can always overcome the rolling moment due to the wings. Approaching a landing, this is especially necessary. In the air, it would be both unnecessary and fatiguing for him to fight the natural rolling of his machine.

A "natural banking" moment can be obtained by the use of a vertical fin above the center of gravity, or by giving the wings an upward dihedral angle. The equivalence of these methods has not yet been determined.

These tests bring out simply the fact that with a sweep back of 10 degrees an appreciable righting moment may be expected without change in any of the other aerodynamical properties of the straight wing.

No reference is made here to the "rotary derivatives" or changes in forces and moments produced by angular velocity. The damping effect of wings on such oscillations can hardly be appreciably affected by sweep back, and accordingly this question has not been investigated.

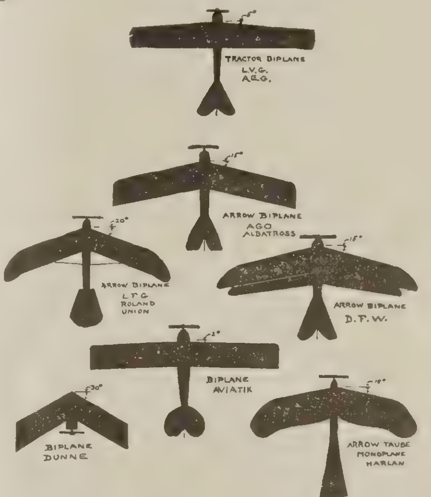


Fig. 33.—Recent Aeroplanes.

Figure 33 shows some types of aeroplanes used in Germany at the present time, and also the English Dunne machine. Both the German machines and the Dunne are reported to be laterally stable in normal flight.

Captain Geoffrey H. Bonnell Takes Charge of British Aviation Office

Captain Geoffrev Harper Bonnell, of the British Royal Flying Corps, the American who is credited with bringing down Boelke, the most intrepid of Germany's airmen, arrived in New York recently to take charge of recruiting for the British aviation service.

Captain Bonnell is the son of J. Harper Bonnell, of Dongan Hills, Staten Island, and is a grandson of John Harper, founder of the publishing house of Harper & Bros. Three days after the outbreak of the war he went to Montreal and enlisted as a private in the 7th Canadian Field Battery. After eleven months' service at the front, during which time he took part in the Somme campaign and the second battle of Ypres, he was recommended for a commission and was sent to England, where he was later transferred to the Flying Corps.

Regulations Governing Entrance to Aero Corps Made More Easy

Owing to recent changes in the conditions under which applications for commissions in the Officers' Reserve Corps, Aviation Section, for flying duty, are favorably considered, it is now possible for men without the formerly required three years' college course, or its equivalent, to be admitted. The minimum age limit has also been lowered.

The present requirements are briefly that candidate for examination to determine their fitness for receiving commissions in the Aviation Section, Officers' Reserve Corps, shall be between nineteen and thirty years of age, possess a college education or its equivalent and be able to pass a stringent physical examination covering eyes, ears, heart, lungs and sense of balance. Any near-sightedness, astigmatism or deafness is cause for disqualification.

In determining the equivalent of a college education, consideration will be given to the applicant's intelligence, business or other training, travel, tutoring, home study, activity and military training. In every case the applicant must have at least a high school or preparatory school diploma.

Detailed information with respect to the applicant's present occupation and past experience, knowledge of foreign languages, technical knowledge, athletic experience and ability, gas engine experience and theoretical knowledge and military training, should be given by all applicants who do not possess a degree from one of the recognized major colleges.

Examining boards give consideration to the above points in making their determinations. The minimum age limit has been fixed at 19 years.

Queen City Aero Club

The Queen City Aero Club has just been established in new headquarters, located at 4014 30th Avenue, Cincinnati, Ohio.

Katherine Stinson to Train Aviators

San Francisco.—Miss Katherine Stinson, who returned May 26 from Japan, where she had been making exhibition flights, will assume her duties as an instructress at the Stinson Aviation School.

FOREIGN NEWS

FRANCE

An experimental hydroaeroplane postal route connecting France and Corsica with stations at Marseilles, Toulon and Ajaccio is being considered by the Ministry of Commerce, says a dispatch from Paris on June 12th.

Adjutant Raoul Lufberry of New Haven, premier "ace" and fighting airman of the Lafayette Escadrille, has just brought down his eleventh "official" enemy plane in a single-handed fight against five Germans, according to word received here June 15th.

It took the American fighter just twenty-five shots to shatter the wings of the adversary plane nearest to him, the German whirling down from the 15,000-foot altitude to death. He exchanged shots with the remaining four and then when the Lafayette flyers came to his rescue the enemy quartet hurriedly sped away.

Lufberry was due in Paris with Lieutenant Thaw of Pittsburgh, Sergeant Charles Johnson of St. Louis, Sergeant Willis Haviland of Minneapolis and Corporal Harold Willis of Boston, to attend a dinner tendered them by the Aero Club of France.

The Americans were to be awarded club medals and a sum of money raised by subscription in commemoration for their bravery and devotion to the cause of France. Lufberry was the guest of the French General commanding the Sixth Army, to which the Lafayette Escadrille will shortly be attached.

The latest exploit of the Lafayette squadron, as a whole, was a remarkably successful bombing expedition over enemy reserve barracks at a point six miles inside the German lines. The entire Escadrille flew at an altitude of a bare 500 feet, disregarding anti-aircraft guns, and fired their machine guns and dropped bombs over military establishments, roads and batteries with good effect.

Details of the death of Lief Barclay, son of the New York physician, who was killed on June 1, were received last week. Barclay was one of the few American aviators in France who was not connected with the Lafayette Escadrille, and he flew an observation machine instead of a fighting machine.

While flying inside of the French lines, near Lure, a wire on his machine snapped and he was dashed to the ground. On the previous day he had been flying over the German lines and his machine was damaged by shrapnel. It is believed that the wires were injured and he failed to realize the fact when he ascended again.

Barclay was a member of the Foreign Legion before he joined the Aviation Corps, and he distinguished himself in infantry attacks. He was one of the aviators who helped carry out The *World's* plan of scattering copies of President Wilson's war message over the German trenches. He was buried near Lure with full miltary honors.

Friends of Joseph Stehlin of Brooklyn, heard, through a letter he wrote, that he has "made good" as an aviator in France and has secured a license. Young Stehlin went to France last January, after being rejected by the Aviation Corps here because of his small stature.

Stehlin, who is twenty years old, is a graduate of Public School No. 98 and St. John's College. He was connected with the Volunteer Life Saving Service at Coney Island. For saving three persons from drowning at Brighton Beach last summer he was awarded a medal by Major Mitchel.

A German aeroplane was brought down in Lorraine on the 12th by special guns. The two aviators were made prisoners.

GERMANY

During May the Germans lost seventy-nine aeroplanes, while the Entente Allies lost 262 machines, says the official statement issued by the German Army Headquarters Staff.

It is asserted that 104 Entente aeroplanes fell behind the German lines and 114 British and French machines were forced down within the Entente positions.

Lieutenant Josef Schaumburg, the first German airman to use an aeroplane in battle and also the first to throw bombs from an aeroplane, was shot down in the battle of Messines on June 11th, falling inside the German lines.

A dispatch also reports the death in action in Flanders of Baron Ernst von Plener, one of Germany's most celebrated aviators.

An attack by German seaplanes on Russian bases in the Baltic is announced by the Admiralty. The statement says that their seaplane squadrons on Sunday, June 10, successfully dropped explosive and incendiary bombs on Russian bases at Libau (on the coast of Courland), and Arensberg (on Oesel Island, at the entrance to the Gulf of Riga). Part of the military buildings were almost destroyed by fire. The German seaplanes returned undamaged.

The German official statement on the latest air raid on London says: "A fleet of our large aeroplanes reached London Wednesday afternoon and dropped bombs over the fort. Good hits were observed during the clear weather. In spite of a strong defensive fire and numerous aerial engagements, during which a British airman fell down over the Thames, all our aeroplanes returned unharmed."

GREAT BRITAIN

The vice-admiral at Dover reported that about 5 a. m. on June 11, a British drifter, while on patrol duty, encountered a group of five German seaplanes and engaged them. One machine was destroyed, the pilot being rescued by another enemy machine. This machine was in turn attacked by the drifter, and both pilots were taken prisoners, the machine being so badly damaged that it sank while being towed into the harbor.

The remaining three enemy seaplanes escaped.

British drifters are small craft whose principle work is mine sweeping, though they also watch for submarines. If, as seems likely, the German seaplanes were in the air and not on the surface of the water when attacked the drifter must have been armed with anti-aircraft guns.

Zeppelin L-43 was destroyed June 14, over the North Sea by naval forces, Chancellor Bonar Law announced in the House of Commons. Soon after being attacked it burst into flames fore and aft and fell into the sea.

London, June 14—Germany's air raid on London of yesterday was the most ghastly of all the aerial attacks which England has seen.

New destructive and pain-making missiles were dropped by the invaders. Most of those injured suffered terribly from acid fluids contained in many of the bombs. Children and women writhed in hospital beds to-day from great burns caused by these missiles.

The official toll of the dead and injured is:

Killed, 104—Children, 26; women, 16; men, 55, including a score of aged men and cripples.

Injured, 403—Children, 94; women, 122; men, 223.

The buildings damaged were of non-military character. Schoolhouses were included in those struck.

There was no disposition to criticise the defensive measures. England realizes that the only way to stop the Germans entirely would be to cordon the air with a vast fleet of patrol aeroplanes. But this is exactly what the Germans want.

Withdrawal of machines from the front would probably take away England's complete aerial supremacy on the western front, blind Field Marshal Haig's "eyes" and maybe seriously hamper the success of his great offensive.

Because the public realizes this, it was determined to bear such losses with fortitude. In all the aftermath discussion, however, there was the prayer expressed that America would soon start a vast aerial fleet overseas. The sooner American airmen get into action on the western front the sooner can Germany's air raids be stopped, in the public view.

Out of its indignation and horror over the raid the British public found time to smile over reports printed in Berlin newspapers that the British government was preparing to move from London on account of the frequency and damage of various air raids.

Officially the story was characterized as "ridiculous." It was stated that all government buildings for many months have been amply protected against air bombs.

All the evening papers take up the hue and cry for an ample warning of future German air raids. They all point out that many lives could have been saved had warning been received in time of the raid. Many cities already have a system of warning the people by sirens or hooters, and also giving a signal when all is safe.

The clamor for reprisals is taking many forms. Some suggest wiping out entire German towns, while others advocate bombing Berlin or Cologne and using a fleet of 500 aeroplanes for such work.

Two persons were killed and sixteen injured in the air raid of June 16th, during which a Zeppelin was brought down. The official report states:

"Last night's air raid was carried out by two airships. One crossed the Kentish coast about 2 a. m. and dropped six bombs on a coast town. According to the latest police reports, two persons were killed, sixteen were injured and a large number of houses were damaged.

"The second raider attacked the east coast town of West Anglia about 2:30 a. m. She was heavily shelled by guns of the anti-aircraft defense and driven off. Shortly afterward this raider, after dropping a number of bombs in open places, was brought down in flames by a pilot of the Royal Flying Corps. The airship was destroyed. There were no casualties or damages in West Anglia."

A dispatch from an East Coast town says that thousands of persons witnessed the destruction of the Zeppelin. The attack by anti-aircraft guns on the dirigible lasted fully half an hour and people issued from their houses half dressed to watch the event.

When the black object drifting across the sky from the southeast to the northwest was seen to burst in flames the spectators cheered tumultuously.

Pedestrians and cyclists dashed off in the direction of the fallen airship, but owing to the unexpectedly long distance few succeeded in locating the Zeppelin, which fell a few miles from the coast. It had been first winged by a land gun and was finished by an aeroplane, which the Zeppelin fought to the last with her guns.

The dirigible dropped in a field of corn, far from any habitation and was completely destroyed.

The British airman who attacked the Zeppelin descended nearby unhurt. According to the story of an inspector who witnessed the affair, searchlights enabled him to follow the movements of the Zeppelin and the attacking airman.

This brings the total victims of German air raids over England to 611 killed. The last previous raid by Zeppelins was made on November 28, 1916, when one person was killed and sixteen injured. On that occasion two dirigibles were brought down in flames, making a total of seven raiding Zeppelins destroyed by English airmen in 1916.

RUSSIA

On June 11, southeast of Jakobstadt, a Russian battleplane was brought down by German artillery and fell in Russian territory. The pilot was killed and the machine destroyed. Northeast of Galicz an enemy airman set fire to a Russian captive balloon, which was burned. The officer observer was hurt.

A report on the eastern front says that Russian airmen have become more active of late, and have flown over German lines on several occasions. Since the beginning of June five Russian aeroplanes have been shot down. The dropping of bombs on Tukkum was replied to by a retaliatory aerial attack by the Germans on Schlok.

Four Russian bomb throwers on the 15th bombarded the railway station at Uzkokoleika, near the small town of Vesen. An enemy squadron of seven machines bombarded Dvinsk and its neighborhood. Russian losses and damage were insignificant. In the region of the Stokhod Russian artillery brought down an enemy aeroplane.

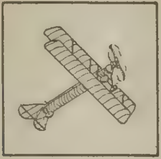
SWEDEN

Zeppelins are continuing their activities in the Gulf of Bothnia. Hardly a day passes without one or more Scandinavian vessels being sunk. The Zeppelins scout regularly along the Swedish coast lines, occasionally coming inside the territorial limits.

A Swedish naval patrol, on June 11th, drove away a Zeppelin to the eastward of Stockholm.

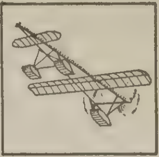
A Zeppelin was observed about 3 o'clock Saturday afternoon, June 16, outside the harbor of Cimbrishamn, Sweden.

A violent cannonade was directed against the dirigible, which withdrew in a damaged condition.



MODEL NEWS

Edited by G. A. Cavanagh



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455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

International Victory for Illinois Model Aero Club

After two years of keen competition for the Aero Club of America's Villard Trophy the Illinois Model Aero Club remains undefeated. The clubs which contested in the National Model Competition included the largest and most active model aeroplane organization in the country. The intense rivalry of the different clubs is shown by the manner in which new records have been established, broken and established, again and again. The fact that in no branch of model flying does a record established before the Competition remain unchanged is a tribute to the Aero Club of America and strong evidence of the success of the National Competition in developing model aeronautics. It is a tribute to the members of the Illinois Model Aero Club that they hold by far the majority of all the records that have been established. The spartan training of the teams which flew in the National Competition has brought results, and the constitution of the club, which gives honor only to those who have achieved extraordinary success, has developed a spirit that has produced two successive victories.

The Design of Model Propellers

Mr. F. J. Cann, the secretary of the Windsor Aero Club, writes the following interesting notes on propellers:

"I do not think any of our members conform to the usual practice of making the pitch one and a half times the diameter (for single-screw models). Indeed, most of us use propellers of almost as coarse a pitch as one used on canard twin-screws, and yet neither of our single-screw models suffer from torque. A suitable disposition of the rudder has much to do with this question. Many beginners undoubtedly fit too small propellers both as regards diameter and pitch, and consequently have trouble with adjustment to the centre of pressure; I myself have seen some models dive vertically after the thrust has ceased, resulting from propellers which 'scream.'

"In the design of a propeller it is undoubtedly convenient to view it as an aerofoil secured about a central axis, the 'lift' of it corresponding to the thrust, and using the air as a nut or fulcrum with which to screw itself forward.

"Carved propellers are used entirely by members. The bentwood may gain a point where weight is concerned, but with regard to efficiency our results show them to be inferior to carved ones; apart from which it is impossible to *design* a bentwood to the same extent as one cut from the solid.

"The writer's formula for calculating the pitch of a propeller may be found useful. It is $P = \pi d \tan A$, where P = pitch, $\pi = 3\,1/7$, d = diameter, A = tip angle, $\tan A$ = a constant. Thus, assuming a propeller to be of 10 in. diameter, and 30° tip angle, we have

$$P = 3\,1/7 \times 10 \times \tan 30$$
$$P = 3.1416 \times 10 \times .5774 = 18.14 \text{ approx.}$$

Illinois Model Aero Club

The Illinois Model Aero Club announced its second annual exhibition Friday and Saturday afternoon and evening, June 15th-16th, Auditorium Hotel. Model flying and gliding contests; actual demonstration of model construction. You and your friends cordially invited.

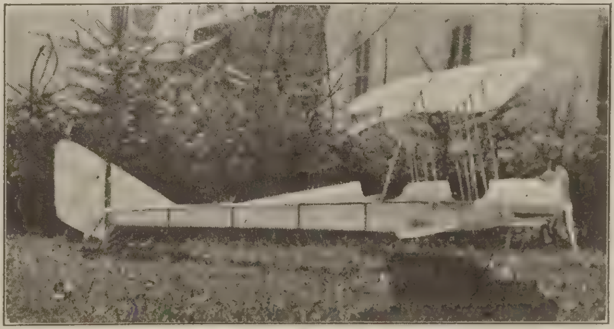
1,227,319. ADVERTISING TOY. Leon C. Robbins, Loveland, Colo. Filed Mar. 20, 1917. Serial No. 156,073. (Cl. 244—12.)

The herein described toy aeroplane having at its front portion a pair of wings standing at a slight angle to each other, at its rear portion a flat tail plane, and at its intermediate portion a shank integrally connecting the wings with the plane, and a truss connecting said wings on their upper sides and holding them in proper relative position.

The herein described toy aeroplane having at its front portion a pair of wings standing at a slight angle to each other, at its rear portion a flat tail plane, and at its intermediate portion a shank integrally connecting the wings with the plane, the fold line between the wings along the center of the toy diverging in two fold lines extending through said shank to points where the side edges of the shank unite with the front edges of the tail whereby the latter and the space between the diverging fold lines stand in one plane, and means for holding the wings at an angle to each other so that each wing and that portion of the shank forward of one of said diverging lines stands in a single plane and out of the plane of the tail.

Gasoline Driven Tractor Biplane

The model shown in the accompanying photograph was designed and constructed by Mr. Ray Schweinsberg, Boonville, New York, and although it was his first attempt at the construction of a model of this size it represents careful workmanship and design. The propeller is operated by a Weiss gasoline engine. The model is of the tractor biplane type and has a total span of 6 feet weighing a little over 6 pounds including the engine. The hood is temporary and the controls have yet to be added. An interesting feature of the model is the manner in which the strut joints are made. They are cut from sheet aluminum the ends of which are bent around the struts, lapped and a single 1/16 inch bolt (or soft pin riveted) put through thus affording a light but strong joint.



Gasoline driven tractor biplane.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

A Suggestion

We have, after deep thought, arrived at what seems to us a perfectly good solution of the aeroplane and submarine problem. 'Tis this: We know that the Germans can't stand any more heavy taxation. Well, why not tax the aeroplanes and submarines, and rather than pay the taxes they will stop operating. Of course, we couldn't be so unsportsmanlike as to wish them not to operate at all, but we believe that once we start this tax system going, only the richest people in Germany will be able to drive their machines. Now, from what we understand of the conditions prevailing in Germany today, there are very few rich men left. When once we have killed them off, there will be no one left in Germany that can afford to fly a machine, because of the heavy taxes we will impose on them.

The only thing that seems to stand in our way in this scheme is the fact that the Germans won't agree to pay any taxes at all, but from books we have read, we have heard that they are a very easily ruled race. We will put the scheme into operation at nine o'clock next Monday morning and will let you know the results.

Heaven Forfend!

Solomon Levi was talking to his friend about the magnificent new house which he had just acquired through the foreclosure of a mortgage.

"Abe," he said, "you wouldn't believe me when I told you. Why, that house of mine is tremendous! The dining-room is so large that thirty people coud sit down to eat at one time, God forbid!"

A Few Technical Predictions

As almost everybody else in this country is making technical discussions as to the trend in aircraft design, we have decided that there is no reason on earth why we should not do it ourselves. And what is more, we are willing to bet almost everything we have, including the family jewels, that not one mistake may be detected in our article.

In the first place we predict that rotary engines will continue to be popular with those engineers who prefer a rotating engine. For those that prefer the upright engine, it is more than likely that the four, six, eight, and twelve-cylinder engines will remain popular. We feel safe in announcing, that as far as we are aware, gasoline will continue to be the chief fuel of the aeronautic engine.

Until a satisfactory substitute ie discovered, crankshafts will be used in all motors. (Except the famous Odor-Engine.) We can say that there are no grounds for the rumors that electric engines will be installed in aeroplanes.

The aeroplane will continue in popularity, and there is no reason to believe that the helicopter and ornithopter will succeed the aeroplane. We predict that the flight around the world, without landing will not be made this year.

And last of all, we predict that if we don't beg, borrow or steal some funny stuff in the near future, either this publication will go to rack and ruin, or we shall lose 1/12 dozen good jobs.

The Cruise of the M-24

(As deleted by the censor)

On a bright morning in .... the flying boat, ... manner by Captain X and a crew of .... men, set out from the port of .... to search for German submarines.

Resolution was written on the face of the commander as he turned to ...., the ablest of his crew and remarked, "........................?" "..................., Captain," the man answered as he walked over to ....
....
....
....
....
"It was quite a battle," said Lieutenant ...., as he got of the boat at ....!

Poetic License

The Air Service is said to contain many poets. Perhaps that is why they spend so much time scanning the enemies lines.—*London Opinion*

.... and by the way, did you know that *The Aeronautic World* is published by the Nippon Hikokenkyukwai, at Honhatchobori, Kyobashi-ku, Tokyo? You have to give them credit for one thing anyway: they certainly use all the letters of the alphabet they can.

A Confession

Although we hate to admit it, we feel that we must. We have absolutely run out of humor, and are gradually becoming more solemn each day. Won't some kind gentleman take pity and send in something funny?

"The Spring Drive"

Courtesy N. Y. Mail.

President Hawley Urges Congress to Quick Action

TO bring to the attention of the House of Representatives and the Senate that at this time when aeroplanes are so badly needed the American aeroplane manufacturers are being kept idle for lack of Government orders, due to the delay in making the necessary appropriations, the Aero Club of America has written to Senator George E. Chamberlain, Chairman of the Senate Committee on Military Affairs, and Congressman H. S. Dent, Jr., Chairman, House Committee on Military Affairs. The letter, which is signed by Mr. Alan R. Hawley, President of the Aero Club of America, reads as follows:

"We must bring to your attention that the delay in making the necessary appropriations for aeroplanes is keeping the aeroplane manufacturers idle, having no orders.

"There are eight aeroplane manufacturers who have facilities for manufacturing 2,000 aeroplanes in three months, and could develop their facilities to manufacture 15,000 aeroplanes within six months, practically idle for lack of Government orders. These aeroplane manufacturers are the Aeromarine Plane and Motor Company, the Burgess Company, the Curtiss Aeroplane Company, the L. W. F. Company, the Standard Aero Corporation, the Thomas-Morse Aircraft Company, and the Wright-Martin Aircraft Company.

"We submit that instead of keeping these manufacturers idle, they should be given large orders to enable them to develop their manufacturing facilities to ten times their present capacity. This they can do easily. These manufacturers are in a better position to arrange to increase their production by ten times than the British aeroplane manufacturers were in the early part of 1915, when the British government gave them the necessary orders to secure the expansion of their manufacturing facilities. As a result, the small British aeroplane manufacturers who could only produce an aeroplane per week in the early part of 1915, are now producing from 5 to 10 aeroplanes per day.

"The same thing can be done by American aeroplane manufacturers. Having well trained organizations they are in a position to add hundreds of workmen and to increase their floor space in a very short time. But they cannot do that unless they get Government orders.

"Realizing that the Government will need first of all between 10,000 and 20,000 training aeroplanes, which, in the interest of efficiency, and quick production, should be of one type, and knowing that the United States, the British, the French, and the Canadian authorities have decided to adopt a certain American type of training machine, which is considered the most efficient machine for training purposes, the Aero Club of America inquired whether the above mentioned manufacturers would be willing to take orders to build that one type, laying aside their own special design. At a meeting of the Aircraft Manufacturers' Association, all the above firms agreed to manufacture any given type of machine which the Government may order. When they came to discuss the possibilities of developing their manufacturing facilities they all found that they had been waiting for weeks for the Government to give them orders, but which have not yet been given, or even promised.

"It has been estimated that, if proper orders are given, eight manufacturers can develop their facilities to supply aeroplanes in the following quantities by next January 1: Curtiss Aeroplane Company, 6,000 machines; Standard Aero Corporation, 2,400; the Aeromarine Plane and Motor Company, 750; The Burgess Company, 750; the L. W. F. Engineering Company, 750; Sturtevant Aeroplane Company, 750; Thomas-Morse Aircraft Company, 750; Wright-Martin Aircraft Corporation, 750.

"We submit that, seeing these firms have all demonstrated their patriotism, most of them being old concerns which have been building aeroplanes for the Army and Navy for past years at a loss, and considering that aeroplanes are so badly needed to instruct the thousands of aviators needed to maintain the Allies' supremacy in the air, this wicked waste of valuable resources should promptly be ended, and every aeroplane factory should be set to work to its utmost capacity.

"We may add that should orders be placed for 20,000 machines of any one type, there would be no possibility of these machines becoming obsolete before they are delivered. Only 20 per cent of the machines used in the present war are fighting machines, where extreme speed is required to fight the enemy in the air. The other 80 per cent are slower machines, used for bombing expeditions, directing artillery fire, scouting and taking photographs, co-operating with the infantry and cavalry, etc. Provided the machines in this other 80 per cent have a factor of safety of four, a few miles more or less speed is of no consequence, as compared with the value of having a large number of machines.

"In conclusion, we beg to urge immediate action in making the necessary appropriations for the building of the 100,000 aeroplanes needed to enable the Allies to achieve a decisive victory and bring this war to an end in the shortest period of time."

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"An aviator is worth an Army Corps."—General Kitchener.

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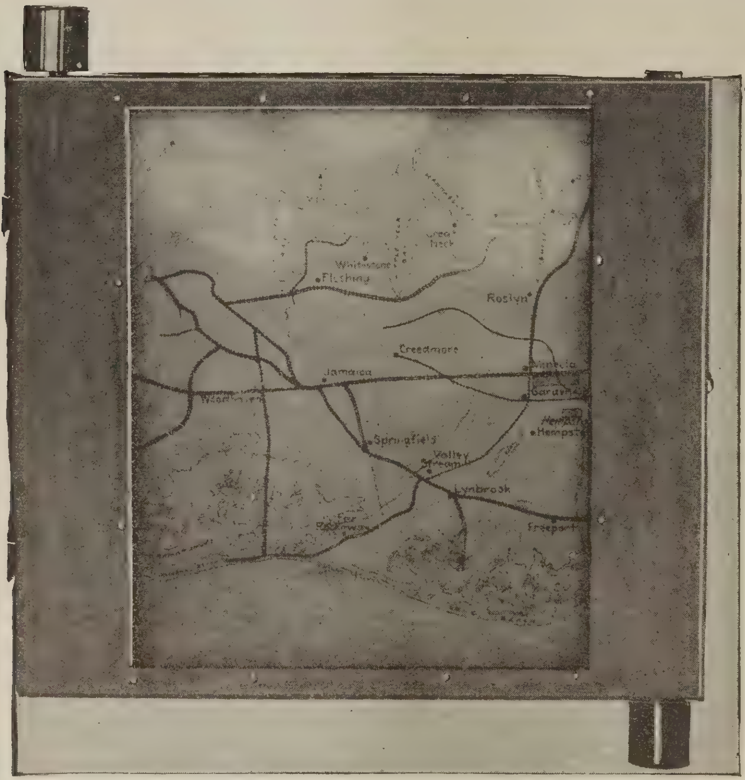

ALWAYS KEEP THE CHART IN SIGHT

Aeronautic Maps

THE Aeronautic Library has secured the exclusive agency from the Sperry Gyroscope Company for the sale of the Sperry Aeronautic Maps and is now ready to deliver maps New York-Chicago; New York-Newport News; Long Island and vicinity, etc.

Every aviator appreciates the value of an accurate map when making cross-country flights, and the Sperry Aeronautic Maps and Sperry Map Holder, supply this necessity.

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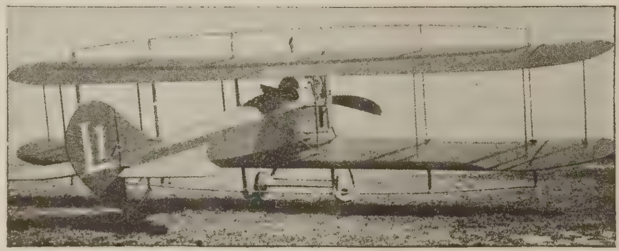

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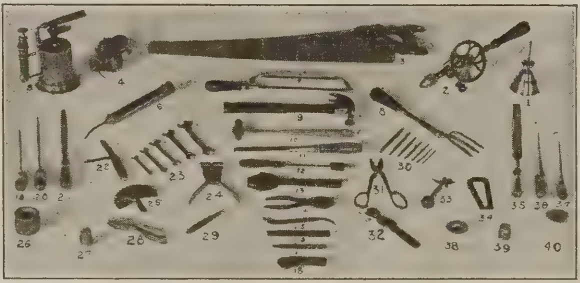

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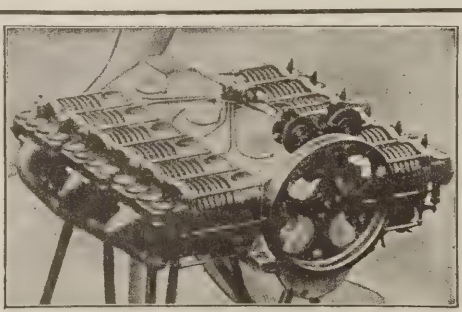

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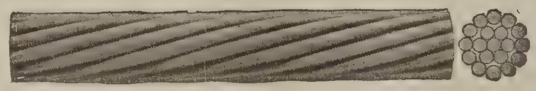

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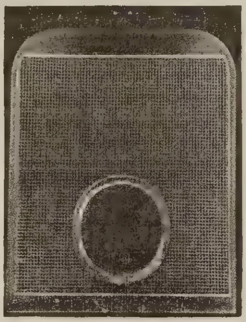

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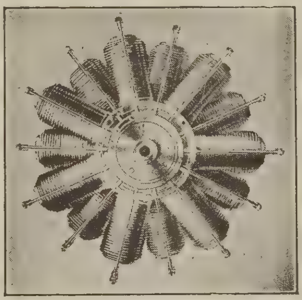

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Flying for June

How the navies of the world use Aircraft Motherships is discussed in a ten page, profusely illustrated article by Henry Woodhouse.

Admiral La Caze, the French Minister of Marine, reported to the Chamber of Deputies recently that France has 552 coast patrol units, with seaplane stations all along the coast, so that the zone of action of each joins that of its neighbor. Admiral La Caze's statement, illustrated by the types of seaplanes used in this work, appears in Flying for June.

Amongst other important subjects dealt with in this issue are: Plans and Personnel of the Aircraft Production Board; Balloon Training; Hunting Submarines from the Air; Rules and Regulations Governing Aerial Reserve Corps; and News of the Aerial Coast Patrol Units.

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AERIAL AGE
WEEKLY

Vol. 5, No. 16 JULY 2, 1917 10 CENTS A COPY

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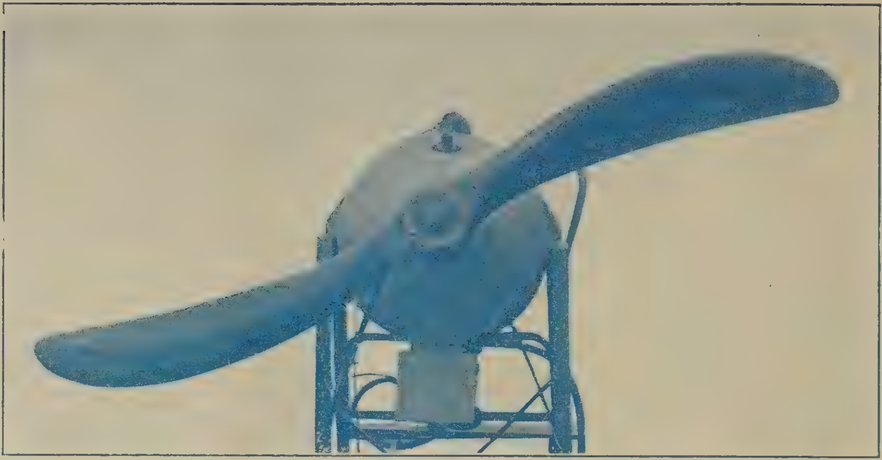
President Wilson Officially Endorses Larger Aeronautic Program



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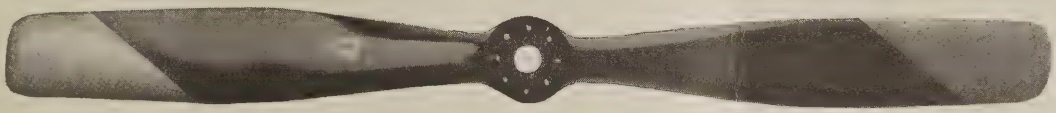

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Mr. Lang, the originator of the Lang Propeller, Ltd., of England, is admitted to be one of the pioneers of aviation.

Under the heading "Pioneers of British Aviation," The Aeroplane, (London) said: "A Dashwood Lang—the first person in England to devote himself seriously and solely to propeller experiments on scientific and practical principles, has developed a great manufacturing concern from his early wood working efforts."

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THE TRADE AUTHORITY

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VOL. V NEW YORK, JULY 2, 1917 No. 16

PRESIDENT WILSON OFFICIALLY ENDORSES LARGER AERONAUTIC PROGRAM

WHILE, as published in the last issue of AERIAL AGE, it was known that President Wilson was in favor of the substantial aeronautic program needed to get the ten thousand aviators and the hundred thousand aeroplanes to strike Germany through the air, his official sanction was required to make his endorsement official. This President Wilson gave on June 23 in the following letter to Secretary of War Baker:

THE WHITE HOUSE,
WASHINGTON.

MY DEAR MR. SECRETARY: *I have your letter of yesterday about the production of aircraft and the training of men to operate them, and want to say that I am entirely willing to back up such a program as you suggest. I hope that you will present it in the strongest possible way to the proper committee of the Congress.*

Cordially and sincerely yours,

(Signed) WOODROW WILSON.

HON. NEWTON D. BAKER,
Secretary of War.

Messrs. Alan R. Hawley and Henry Woodhouse, who were in Washington last week testifying on behalf of the aeronautic program before the House and Senate Committees on Military Affairs, state that the Senate and House representatives as well as Secretary Baker and Secretary Daniels, are in favor of the increased plans.

Need a Separate Department

Alan R. Hawley and Henry Woodhouse, having been requested to give to the Senate Committee on Military Affairs their views on the subject, made the following statement:—

"Our reasons for urging the creation of a Department of Aeronautics, are briefly:—

"It is a foregone conclusion that the war is going to be decided in the air, in favor of the side which has command of the air. The foremost European strategists have expressed themselves to that effect. And there has been evidence in all the recent Allies' victories, where command of the air led to victories.

"It is also generally accepted that the quickest, most effective and most economic way of striking a decisive blow to Germany is to strike through the air.

"It has been estimated that had the Allies 25,000 additional well equipped aviators to-day they could practically smother Germany and secure decisive victory—achieving what an additional million soldiers could not achieve.

To Train the Aviators

"To train this large number of aviators and arrange for the manufacturing of the aircraft needed will require a large administrative personnel and the total expenditure of about $1,000,000,000. The administration of the British Air Service in London alone in the official aeronautic building (which was the Cecile Hotel) employs, according to the official report submitted to the House of Commons, 419 officers. The administration building of the British Air Service is larger than the United States Army and Navy Building, and the number of officers compares well with the number of officers engaged in the administration of the United States Army and Navy.

"The United States War and Navy Departments already are overwhelmed with work and have neither the office facilities nor the personnel required for the administration of an adequate air service, and whereas this administrative force has to be organized, efficiency and economy demand that we take advantage of the experiences of our Allies and immediately create a Department of Aeronautics to undertake this very important work without delay and confusion.

"There are even more reasons for creating a Department of Aeronautics in the United States than there was for creating the British and French Air Ministers, because England and France had large military and naval administrative forces which it seemed advisable to utilize, and the British and French air services are operated on British territory, and after the war started the countries were forced by the exigencies of war to not attempt to do anything which might cause confusion—and they feared that to attempt to operate the already established air services from the War and Navy Departments might lead to confusion. But they had to take that step, and efficiency and economy dictate that we learn the lesson and start in by creating a separate Department of Aeronautics.

Avoid England's Mistakes

It would be fatal to permit the United States to involve itself in the awful conditions in which England was led as a result of the failure to have an air ministry to manage the developing of the aerial forces which led to confusion and nation-wide trouble which resulted in successive changes of governmental administration.

"Finally, one of the first steps of the new British Cabinet was the establishing of the Air Ministry with a Cabinet officer at its head. Sir Cive, the British Secretary of State of the Home Department, announced the establishing of the Air Ministry in the House of Commons on December 19, 1916.

"The present composition of the British Air Ministry, as reported in the House of Commons on April 26, is as follows: —There is a President, a Director General of Military Aeronautics; the Fifth Sea Lord, who is director of the air service of the Admiralty; a Controller of Aeronautical Supplies, who is an officer of the Ministry of Munitions, and a Controller of Patrol Engines, equally an officer of the Ministry of Munitions, and there is a Parliamentary Secretary, who, in the absence of the President, presides at the meetings.

"Besides undertaking the training of the thousands of pilots and the manufacturing of the tens of thousands of aeroplanes needed to secure decisive victory against Germany, the new Air Ministry, the creation of which we urge, would undertake the organizing of an efficient system of aerial coast patrol for the defense of our shipping and our coasts. This very important work has hardly been considered so far. The only aerial coast patrol stations in operation are the stations established at private expense, and the hundred or so aerial coast patrol aviators, trained or under training at private expense.

British Aero Stations

"There was made known some months ago that there are 107 aero stations in Great Britain alone. Great Britain alone has 1,500 miles of Coast.

"At present Great Britain, France, Russia, Germany and Austria count their aeroplanes by the tens of thousands and dirigibles by the hundred. Their present plans of increase of production provide for increasing the number of aeroplanes to hundreds of thousands. For instance, the British government is spending $575,000,000 this year for aeronautics and the other countries are spending more or less the same amount. The report of the British Comptroller of Aeronautical Supplies shows that there are 958 firms engaged in aeronautic work for the British government. Of these 301 are direct contractors and 657 are sub-contractors. The total number of hands employed by the fifty firms of most importance is 66,700.

"The report of the British government also shows that the British air services have about 500,000 aviators, dirigible pilots, kite balloon operators, mechanics and assistants. The operation of these air services extend to every part of the world having aeronautic stations in Europe, Asia, Africa, America and Oceania. The Air Ministry, as already stated, includes an administrative force comprising 419 officers, including a Cabinet officer, a Sea Lord and several generals."

THOUSANDS OF YOUNG MEN NEEDED FOR U. S. AIR SERVICE

INSTEAD of being swamped with applications from would-be aviators, the government, it was officially declared recently, is anxious for thousands more of young men for the air service.

At present there are about 800 students at the various ground schools. Men are being delegated to the work in the colleges at the rate of twenty-five a week for each school, or about 200 a week. After August 25 the government expects to graduate students into the advanced flying fields at the rate of 200 a week. The number to have been put into active flying by September 8 has been set at 1,408, but the total probably will be less, due to the weeding out process which is going on continually.

The manning of our six flying camps—which will grow to a total of twenty-four before the end of next year—is another story. The government wants aviators and yet more aviators. It wants them by thousands, and it does not intend to turn away any good material.

Where Applications Are Taken

The places where applications are taken are as follows:

The Signal Corps, War Department, Washington.
The Mineola Field, Mineola, Long Island.
The Essington Flying Field, Essington, Penn.
Fort Sam Houston, San Antonio, Tex.
North Brothers Island, San Diego, Cal.
Signal Officer, Central Department, Chicago.
Fort Omaha, Omaha, Neb.

As a result of misinformation that the aero camps were "swamped," men between the desirable ages of nineteen and twenty-five began volunteering in droves for the "mosquito fleet," under the idea that if they couldn't get the Germans from the air they could get a shot at a submarine. As a result, the country is still calling for flying recruits.

The government, through the services of the Signal Corps and its enterprising head, General Squier, is going on an enormous scale to teach young men how to fly.

The students entered upon the rolls of the ground schools located at the universities of Texas, California, Ohio, Illinois, Cornell, the Massachusetts Institute of Technology, Princeton and the Georgia School of Technology are called cadets, and until supplied with uniforms will wear a distinguishing band on their sleeves.

Not Having an Easy Time

These cadets have no easy time, by all reports, and the course of study, although fascinating, requires quick thinking, application and accuracy. The first course, devoted to theory, lasts eight weeks. Those who can pass the examinations at the end of this time are graduated to the aviation school, where practical flying over a period of time varying from three to four months is taught. Cadets are called upon to prepare for examinations in the following subjects:

Engines.
'Cross-country and general flying.
Signalling and wireless.
Aerial observation.
Gunnery, military studies.

The first subject takes the student in the beginning through a thorough course on the operation and construction of stationary engines, and later into the intricacies of the rotary engine and the magneto theory.

The theory of flight includes a number of subjects, embracing the history of human flight and the physical problems involved in flying. The student is taught to distinguish between the various kinds of machines and to be familiar with their points, their care and repair. The mysteries of sail-making and splicing are revealed; rigging and landing ground are explained in practical illustrations. Among the most important things to learn is the contents of that wizard's bag which saved many an aviator's life—the tool kit.

Must Study Astronomy

In the study of 'cross-country flying the cadet is supposed to take up such abstruse subjects as meteorology and astronomy; the first to "show which way the wind blows" and the second to give a familiarity with the stars, which will enable the nightbound aviator to guide without compass. Everybody knows the supreme importance of photography in military flying, as practised on the Western front. To know your camera and when to "shoot" as your machine goes zig-zagging over enemy territory is an accomplishment which the military airman cannot do without.

With these important ideas in mind the instructors in ground schools are giving an especially thorough course in artillery observation. The study of the "miniature range" is especially fascinating and a good test of eye keenness, cool-headedness and sense of direction.

A miniature of the enemy country is painted on a board and the cadet sits on an elevated platform at a distance above his objective which will, as far as vision is concerned, approximate his views of the earth while flying at a fighting height. Landmarks are shown on the chart and the instructor indicates some spot at which an imaginary battery is firing. It is the job of the student to correct the aim of the hypothetical big gun.

Map Reading a Feature

Map reading, too, is an item to which the student must give his prayerful attention. The most skilful aerial performer lacking a thorough knowledge of maps and what they mean might set out for home some fine night and find himself landing in a cozy camp where only German is spoken.

In the study of gunnery the prospective flyer comes in for one of the hardest courses in the school. He must learn the technique of the machine gun and be able to take it apart and put it together again.

Great stress is put upon radio work, for it is of paramount importance that every war aviator shall be an expert wireless telegrapher. When it is stated that a flyer, under battle conditions, is called upon to run his machine with one hand and signal to the artillery with the other, it will be understood how indispensable is a thorough knowledge of radio technique.

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Liberty—I see YOU coming
Through the awful wreck of war
Fellow comrades up and meet her!
As we've met her THRICE before,
Ready, to throw in our *treasure*
Lives—yes—all for her great sake.
Comrades up—and give full measure
Europe's war—holds our LIFE STAKE
We staked all that man might follow
In the paths of freedom sweet.
Well we know her blessed features,
On! there must be no retreat.
CZARS and KAISERS they are going
Up, my comrades, help them go
In this war to free great peoples
Liberty's blest fires glow,
Burning—burning—but we see her
Working out her wond'rous plan
Right to live in a free country
This, to each and ev'ry man—
Fellow comrades, up and meet her
As we met her thrice before;
Liberty, we see you coming
Through the awful wreck of war.

ALICE HUNT BARTLETT,
(Mrs. William Allen Bartlett.)

THE NEWS OF THE WEEK

Contract for New Flying Field in Illinois Awarded

X The War Department authorizes the following: The Signal Corps today announced the letting of the contract for the fourth of the new Government flying fields, to be built at Belleville, Ill., 23 miles from East St. Louis. It will be a standard two-squadron field, accommodating 300 student fliers, with the requisite number of officer instructors, mechanics, and enlisted men, and providing hangars for 72 training planes. Construction of the buildings and the preparation of the field will begin immediately.

The locations of the fields already announced are Dayton, Ohio; Mount Clemens, near Detroit, Mich.; and Rantoul, near Champaign, Ill. The Government's present plans contemplate letting the fifth contract in about two weeks and the remaining four of the nine fields already authorized at successive intervals of two weeks thereafter.

The preparation of the three fields already started has been made an emergency job, and the Chanute Field, at Rantoul, Ill., is already nearly half done. The contract for Chanute Field was let on May 24 and work began on May 27. Substantial progress has also been made on the big four-squadron Wilbur Wright Field at Dayton and the Selfridge Field at Mount Clemens, Detroit. The authorities hope to have men flying on all three of these fields by the middle of the summer.

French and British Experts Discuss Aeronautic Program

The National Advisory Committee for Aeronautics authorizes the following:

At a recent meeting of the executive committee of the National Advisory Committee for Aeronautics, held at the Smithsonian Institution, plans for the participation of the United States air forces in the war were extensively discussed. The meeting was attended by experts of the British and French commissions and an American aeronautical engineer who had just returned from an extensive tour of observation in England.

The plans provide for a very large increase in the number of aeroplanes and other forms of aircraft, mechanics, repair men, and necessary equipment. This flying force will be so thoroughly equipped and trained that with a long continuation of the war it may very probably prove to be the deciding factor.

Designing Standard Engine to Drive American Aircraft

The National Advisory Committee for Aeronautics authorizes the following:

The Aircraft Production Board, realizing the need for the development of a standard engine in various sizes has succeeded in obtaining the co-operation of two of the foremost engine designers in the country, Messrs. Vincent and Hall. The fundamental idea of the engine is a unit cylinder by means of combinations of which any desired power may be obtained. It is proposed at first to build engines in four sizes of 4, 6, 8, and 12 cylinders, the corresponding horsepowers being approximately 100, 200, 300, and 400.

The co-operation obtained in the design of this engine has shown the feeling of patriotism which is common throughout the country. Requests were sent out from the foremost engine draftsmen with the various automobile and airplane companies throughout the country, and the volunteers worked night and day without compensation.

The facilities of the Bureau of Standards for the assembly of this engine have been placed at the disposal of the Aircraft Production Board, as well as the accumulated knowledge of the bureau and its staff of the various metallurgical processes necessary for the successful completion of the engine.

The development of this engine will in no wise interfere with or retard the development of private manufacturers, but, if anything, should stimulate them to further effort.

Will Use Many Industries in Building U. S. Aircraft

The Council of National Defense authorizes the following:

Manufacturing equipment in many different industries will be utilized in the consummation of the great aircraft building program mapped out by the Government and soon to be laid before Congress, according to a statement issued by the aircraft production board of the Council of National Defense. Existing aircraft factories will be enlarged and will be concentrated upon some one of the types of machine needed by the War and Navy Departments. Motor building plants, sewing machine and typewriter plants, woodworking and other manufacturing institutions will play their part in this work.

"The facilities of many available industries capable of adaptation to motor and aeroplane construction will be used in the work," the statement says. "Orders will, of course, be given to all reliable existing aeroplane manufacturing plants capable of turning out the quality of machines which the Government must have, and this will enable them to extend their factories for more extensive production.

"The aircraft industry has never been extensively encouraged and developed in this country, however, and in order to secure the quantity production necessary we must draw on far wider resources.

"In all the arrangements which have been planned the most intensive care has been given to the business form of the proposed contracts, so that while the firms which will be engaged in the manufacture of these machines will be assured of adequate capital to secure the expansion and adaptation of their plants, the Nation will be thoroughly protected from the danger of paying excessive profits through an undue stimulation of prices. A detailed and thoroughly worked out business program will be submitted to Congress at the same time that the bill is introduced, or shortly after."

Lelands to Leave Cadillac for Aircraft Work

Detroit. — Henry M. Leland, president and founder of the Cadillac Motor Car Co., and his son W. C. Leland, vice-president and general manager of the company, have resigned. Both father and son will end their duties with the Cadillac company July 31, the end of the fiscal year, and will begin the manufacture of war aeroplanes for the United States Government on a large scale.

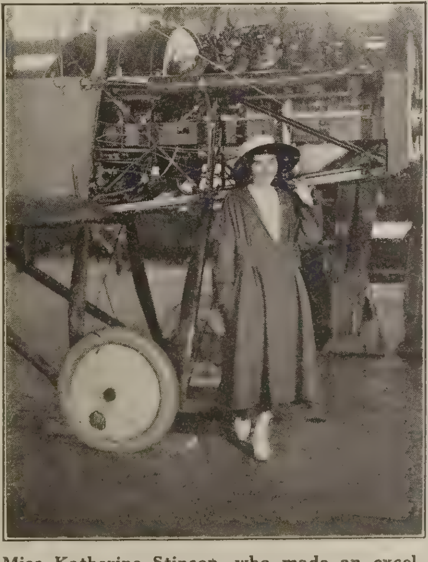
Mr. Leland is not yet ready to state where his new factory will be located, although he and his son have carefully mapped out the plan of procedure. They expect to manufacture on a huge scale. Early in the war Mr. Leland visited England to study aviation needs and conferred with Lord Montague, Lord Sydingham, Sir Albert Stanley, and others. He has recently been in constant conference with members of the Council of National Defense.

Ackerman Wheel Co. to Manufacture Aeroplanes

Milwaukee, Wis.—It is reported that Duluth-Superior, the twin ports at the head of Lake Superior, are to be made the aeroplane producing center of the Northwest. Within 60 days the Ackerman Wheel Co., Cleveland, will establish an assembling plant in Duluth, and as soon as possible a complete aeroplane factory costing about $200,000 will be erected.

Marmon Gets Aero Engine Contract

Washington.—One of the first steps in connection with the appropriation of $600,000,000, which is now before Congress for aeroplane manufacture, is the letting of a contract to the Marmon company, Indianapolis, for the manufacture of 1,000 aeroplane motors. The Marmon company is erecting a new factory for the manufacture of these which will have a total floor area of over 50,000 sq. ft. This factory is to be completed within 55 days. The motor to be built by the Marmon company is the Hall-Scott.



Miss Katherine Stinson, who made an excellent flight from Buffalo to Washington in a Curtiss J-N military tractor on behalf of the American Red Cross

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Curtiss Plant for Toledo

Toledo.—John N. Willys will become the new president of the Curtiss Aeroplane Co. and Toledo will soon have within its boundaries a large plant, close to the Willys-Overland Co. factory, for making all Curtiss engines.

Mr. Willys in a statement says, "The Willys-Overland Co. has been preparing for the manufacture of aeroplane engines for nearly a year. It has had two engineers who just recently returned in England studying the English method of manufacture, so we are familiar with the latest English and French practice in building engines. We have a surplus quantity of machinery necessary for engine manufacture, so we are in good shape to take care of governmental requirements in connection with the Curtiss company. There is no question about the necessity of the aeroplane in war, and it is generally conceded by British officers, with whom I have talked, that aeroplanes will be in general use after the war because of the large number of aviators trained for fighting."

Aviation School Squadron News

First Aviation School Squadron, San Diego, June 9, 1917: More than 320 flights were made with a total duration of 228 plus hours. A class of eleven students made cross country flights to Los Angeles and return on the 8th. This day's flying totalled 68 flights, duration 75 hours, 20 minutes, a new duration record for flights made in one day.

On Registration Day 12 aeroplanes flew over the ceremonies at the Stadium. Captain Byron Q. Jones, J.M.A., S.C., has left San Diego for temporary duty in Washington in connection with the new Langley Field work being prosecuted by the Aircraft Engineering Division.

The following Regular Army fliers have been recommended for rating as Junior Military Aviator:

Captain Bane, Lieutenants Jernigan, Boots, Burwell; Capt. Gearhart, Lieutenants Rhinehardt, Deuel, Rossell, Peck, Peebles. Lieut. Smith, New Mexico National Guard, has also qualified for this rating.

Third Aviation School Squadron, Ashburn, Ill., June 16, 1917: The week's work included 138 flights, totalling 50¼ hours. Other instruction included aerodynamics, electricity, meteorology, motors and military routine. On the 16th ten aeroplanes left the field to participate in combined military field maneuvers in conjunction with Chicago High School students at Maywood, Ill.

Third and Fourth Aviation School Squadron, Ashburn, Ill., June 9, 1917: The total flights for the week amounted to 25, duration 6 hours. High winds prevented a greater total.

Second Reserve Aviation School Squadron, Essington, Pa., June 16, 1917: One hundred and twenty-four instruction flights were made during the week with a total of 41½ hours. The Examining Board at this point continues to receive and act upon applications for flying and non-flying duty in the A.S., S.E.R.C.

Orville Wright Receives Degree

Cincinnati, O.—On June 16, at the University of Cincinnati, Orville Wright received the degree of Doctor of Science. Speaking of the war he said that aircraft will end the conflict.

"The only way the conflict can be brought to a finish is through the flyers," he said, "otherwise it will remain a stalemate as it is now. The Allies must have the greater number of aeroplanes for observation.

"The airmen must be so many that they can immediately be cognizant of everything the enemy undertakes. This, and this only, will cause success."

Yale Sends Aviators to France

New York City.—Eleven more American aviators have sailed recently to join the Lafayette Flying Corps with the French Army. Their names are George C. Moseley of Highland Park, Ill., who was the left end in the Yale football team for two years; Dumares Spencer, also of Yale and Highland Park; Alan F. Winslow, River Forest, Ill., Yale football team; Curtis B. Munson of New York and Yale University, Harry P. Carlton of Buffalo and Yale, Gorman De F. Larner, son of the late Robert M. Larner, founder of the Gridiron Club at Washington, and an athlete of Columbia University; John F. Rolph of Centreville, Md., John H. Baugham, Washington, N. C.; Robert B. Hoeber of Nutley, N. J.: Clarence W. Bosworth, New York, and John T. L. Jeffries of Boston.

Katherine Stinson Flies from Buffalo to Washington

Miss Katherine Stinson, who recently returned from a most successful exhibition trip in Japan, broke all her records for cross country flying June 25-26, when she flew from Buffalo to Washington in a Curtiss J-N military tractor.

Miss Stinson offered her services to the Liberty Loan and Red Cross organizations to deliver by air route the checks contributed in Buffalo, Syracuse, Albany, New York and Philadelphia. Brigadier-General George O. Squier gave the Curtiss Company permission to supply the machine with which the flight was made. The total distance covered was 670 miles, and the flying schedule was as follows: Left Buffalo 11.50, arrived Rochester 12.45. Left Rochester 2.15, after lunching with the Red Cross members, arrived Syracuse 5 p. m., and Albany 6.40 p. m. Miss Stinson spent the night in Albany, leaving at 10 a. m. the next day and arriving at Governor's Island at 12.17. She left Governor's Island at 2 p. m. and arrived at Philadelphia at 3.10. A delay occurred at Philadelphia through the helpers not being on the ground to fill the gasoline supply. Press despatches stated that the delay was due to motor trouble, but this was entirely incorrect. Miss Stinson states that her motor worked perfectly throughout the trip. Washington was reached at 7.45 p. m., where Miss Stinson was received by Secretary McAdoo and representatives of the Red Cross.

Information Relative to Enrollment in the U. S. Naval Reserve Flying Corps, Naval Defense Force Class 5.

Presented below is the official statement issued by Hon. Josephus Daniels, Secretary of the Navy, concerning enrollment in the U. S. Naval Reserve Flying Corps.

1. *Requirements for commission* in the Naval Reserve Flying Corps are: American citizenship; physical requirements similar to those for Naval Flying Corps; proficiency in actual operation and care of aircraft; recommendations from three reputable citizens. Educational qualifications will be given special consideration in selecting applicants for enrollment.

2. *Requirements for training for commission* in the Naval Reserve Flying Corps are: American citizenship; physical requirements similar to those for the Naval Flying Corps; recommendations from three reputable citizens. Educational qualifications will be given special consideration in selecting applicants for enrollment.

3. Blanks for *application* for commission, or for training for commission, will be furnished upon request addressed to the Supervisor, Naval Reserve Flying Corps, Bureau of Navigation, Navy Department, Washington, D. C. After application has been returned to the Supervisor with entries made and required letters of recommendation appended, the applicant is notified of the approval or disapproval of his application. If approved, he is directed to report at a designated place for examination and, if found qualified, is there *enrolled*. He is thereafter subject to call to active duty at any time during war. During peace he shall at any time be discharged at his own request, or by proper authority. After enrollment and while awaiting call to active duty he performs no Naval duty.

4. If enrollment is for training for commission, the enrollment is made as Seaman Second Class in Class 4 of the Naval Reserve. Upon completion of the training period, the man so enrolled is examined and, if found qualified, is transferred to Class 5, the Naval Reserve Flying Corps, and is commissioned.

5. All first commissioning is provisional, and is subject to confirmation, upon examination, after not less than three months of active duty.

6. Enrollment as a mechanic in the Naval Reserve Flying Corps is by application to the Commandant of the Naval District in which the applicant resides. District headquarters are as follows:

1st Naval District—U. S. Navy Yard, Boston, Mass.
2nd Naval District—U. S. Naval Station, Newport, R. I.
3rd Naval District—U. S. Navy Yard, New York, N. Y.
4th Naval District—U. S. Navy Yard, Philadelphia, Pa.
5th Naval District—Citizens Bank Building, Norfolk, Va.
6th Naval District—U. S. Navy Recruiting Station, Charleston, S. C.
7th Naval District—U. S. Naval Station, Key West, Fla.
8th Naval District—U. S. Navy Yard, New Orleans, La.
9th Naval District }
10th Naval District } U. S. Naval Station, Great Lakes, Ill.
11th Naval District }
12th Naval District—417 Sheldon Building, San Francisco, Cal.
13th Naval District—U. S. Navy Yard, Puget Sound, Wash.

7. The total number at present to be so enrolled is limited. If accepted, and enrolled the applicant performs no Naval duty until ordered to active duty. He is in war liable so to be ordered at any time after enrollment. In time of peace he shall be discharged at any time at his own request or by proper authority. The applicant should state his age and give his qualifications and experiences in full. *Requirements* in general are: American citizenship, previous experience as aeronautic mechanic or in allied skilled trades, and reputable character.

8. *Pay and Allowances*—The act of Congress approved August 29, 1916, provides as follows:

"All members of the Naval Reserve Force shall, when actively employed as set forth in this Act, be entitled to the same pay, allowances, gratuities, and other emoluments as officers and enlisted men of the naval service on active duty of corresponding rank or rating and of the same length of service. When not actively employed in the Navy, members of the Naval Reserve Force shall not be entitled to any pay, bounty, gratuity, or pension except as expressly provided for members of the Naval Reserve Force by the provisions of this Act.

"Enrolled members of the Naval Reserve Force may, in time of war or national emergency, be required to perform active service in the Navy throughout the war or until the national emergency ceased to exist.

"Members of the Naval Reserve Force shall, upon first reporting for active service for training during each period of enrollment, be credited with a uniform gratuity of $50 for officers and of $30 for men.

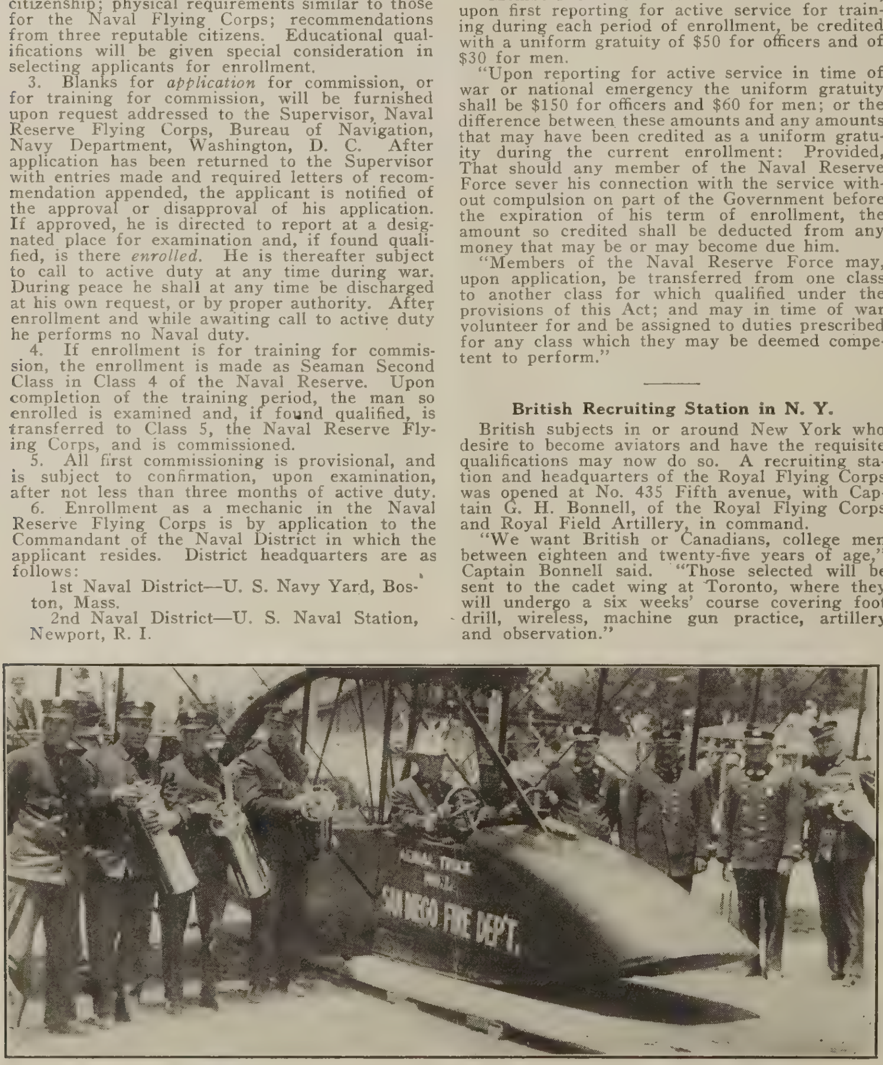
"Upon reporting for active service in time of war or national emergency the uniform gratuity shall be $150 for officers and $60 for men; or the difference between these amounts and any amounts that may have been credited as a uniform gratuity during the current enrollment: Provided, That should any member of the Naval Reserve Force sever his connection with the service without compulsion on part of the Government before the expiration of his term of enrollment, the amount so credited shall be deducted from any money that may be or may become due him.

"Members of the Naval Reserve Force may, upon application, be transferred from one class to another class for which qualified under the provisions of this Act; and may in time of war volunteer for and be assigned to duties prescribed for any class which they may be deemed competent to perform."

British Recruiting Station in N. Y.

British subjects in or around New York who desire to become aviators and have the requisite qualifications may now do so. A recruiting station and headquarters of the Royal Flying Corps was opened at No. 435 Fifth avenue, with Captain G. H. Bonnell, of the Royal Flying Corps and Royal Field Artillery, in command.

"We want British or Canadians, college men between eighteen and twenty-five years of age," Captain Bonnell said. "Those selected will be sent to the cadet wing at Toronto, where they will undergo a six weeks' course covering foot drill, wireless, machine gun practice, artillery and observation."


SAN DIEGO FIRE DEPT.

The first flying boat fire department, with headquarters at San Diego, Cal.

Army and Navy News

The following are detailed in Aviation Section of S. C. and rated as a junior military aviator from date after his name, all in 1917: Capt. John N. Reynolds, C.A.C., D.O.L., June 15; 1st Lieuts. Arnold N. Krogstad, 22d Inf., June 15; Harry M. Brown, 22d Inf., June 16; James R. Alfonte, Inf., D.O.L., June 17; Michael F. Davis, Inf., June 18; Patrick Frissell, 52d Inf., June 19; Adlai H. Gilkeson, Inf., June 20; Hubert R. Harmon, C.A.C., June 21; Jack W. Heard, 17th Cav., June 22, and Whitten J. East, Inf., June 23. (June 14, War D.)

First Lieuts. Joseph H. Stevenson and Alexander B. Thaw, 2d Aviation Section, S.O.R.C., to report at Governors Island for duty with 1st Aero Reserve Squadron. (June 15, War D.)

Capt. Max C. Fleischmann, S. O. R. C., to Fort Omaha, Balloon School, for duty. (June 15, War D.)

First Lieut. Daniel P. Morse, Jr., S. O. R. C., to report for duty at New York, N. Y., in connection with the organization of the 1st Reserve Aero Squadron. (June 15, War D.)

Capt. Ray W. Bryan, Medical Corps; Capt. Byron Q. Jones, junior military aviator, Signal Corps; and First Lieut. Henry J. Damm, Infantry, Detached Officers' List, are detailed as members of the board of officers appointed in paragraph 12, Special Orders, No. 198, August 24, 1916, War Department, Vice-Maj. William R. Davis, Medical Corps; Maj. Frank P. Lahm, junior military aviator, Signal Corps, and Capt. William A. Robertson, junior military aviator, Signal Corps, hereby relieved.

Capt. Clarence C. Culver, Cavalry, Detached Officers' List, will make not to exceed three trips to Hampton, Va., during the month of June, 1917, on official business pertaining to radio and photographic equipment for aeroplanes for the army, and upon the completion of the duty enjoined will return to his proper station in this city after each visit.

Capt. Virginius E. Clark, junior military aviator, Signal Corps, will proceed to Detroit, Mich., for temporary duty in connection with aeronautics of the Army, and upon the completion of this duty will return to his proper station in this city.

First Lieut. Daniel Backley, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Fort Sam Houston, Tex., and report in person to the commanding general, Southern Department, for assignment to duty with an aero squadron.

Maj. Hiram Bingham, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the Chief Signal Officer of the Army for duty in his office.

Capt. Byron Q. Jones, junior military aviator, Signal Corps, will report to the senior member of the Joint Army and Navy Aircraft Board, Washington, D. C., for temporary duty.

Maj. Charles de F. Chandler, Signal Corps, will make not to exceed six visits to Hudson, N. Y., on official business pertaining to aeronautics of the Army, and upon the completion of the duty enjoined will return to his proper station in this city after each visit.

Capt. Frank C. Page, Signal Officers' Reserve Corps, will proceed to Toronto, Canada, for temporary duty in connection with the Aviation Section of the Signal Corps, and upon the completion thereof will return to his station in this city.

Statement Concerning Curtiss Aeroplanes and Willys-Overland

C. M. Keys, vice-president of the Curtiss Aeroplane & Motor Corporation, who assumed chief executive charge of the Curtiss Corporation late in 1916, recently confirmed the report of negotiations for a combination between the Curtiss Corporation and the Willys-Overland interests. To a representative of Dow, Jones & Co., Mr. Keys explains the reasons why it seemed advisable to establish co-operation between these two concerns and in what way the two organizations will co-operate. He says:

"The fundamental reason for a working agreement between these two corporations is a simple one. Curtiss Aeroplane & Motor Corporation is a leader in its field, not because of its productive power as a manufacturer, but because it is now and always has been a leader in the experimental and development phases of the aeroplane business. When it became evident last Winter that a large production of aeroplanes of standard design would be required in this country, it also became obvious that this corporation must develop very greatly its manufacturing power, or else other people would come into the field, take the developed models of machines and motors, and manufacture them in quantity, so relegating this corporation to a secondary place, at least for the period of the war.

"Since that time, the principal thought of the officers and directors of the Curtiss Corporation has been to find the best and quickest way to give that corporation a lead in the manufacturing of aeroplanes and motors such as it already held in the development of aeroplane and motor types. In the Willys-Overland organization production is the key note. That corporation has succeeded in getting production in various types of machine and motor, from the standard block type motor with poppet valves to the much more difficult Knight type with fine tolerances and very accurately assembled.

"A working arrangement between these two corporations, each a leader in its line and each supplementing the other to perfection, is the most obvious solution that could be devised for a very big and very momentous problem brought about by the war. This problem was, in effect, to bridge in six months the gap between the experimental and the production stages of an industry. If the co-operation between the two is as perfect as it seems likely to be the aeroplane industry will have advanced at least as far in that six months' period as the automobile industry advanced in ten years.

"As to the actual working co-operation between the units of the two companies, the facts are equally obvious. Curtiss Corporation was and is largely an assembling proposition, so far as manufacturing is concerned. It obtains its parts both for aeroplane and motors from a very large number of vendors throughout the country. Some of its principal manufacturing difficulties have arisen from the natural difficulty in obtaining and keeping close co-ordination between so many sources of supply scattered all over the country. At the present time faced by the necessity of increasing its production to a very large extent, it will be possible for the corporation to maintain its present sources of supply and at the same time supplement and strengthen its flow of material by using the facilities of the Willys-Overland, and allied companies, whenever and wherever these companies can furnish fabricated parts as cheaply and of as good quality as can be obtained elsewhere.

"It happens, for instance, that one of the principal Willys-Overland factories is at Elmira, which is forty miles from Hammondsport, where the principal motor factory of the Curtiss organization is located. This Elmira factory, when it is not running full on Willys-Overland work, can and will handle or produce three out of four of the parts that enter into the construction of the Curtiss motor, which is assembled at Hammondsport. The advantage in production of having concentrated sources of supply nearby, in addition to the scattered sources from which parts are now drawn, is too clear to require further comment.

"So far as motor production is coneerned, Willys-Overland organization appears to be entirely capable of taking an entire contract, both for fabricating and assembling Curtiss training motors, which seem to be about to be required by the United States Government in quantities very much larger than could possibly be turned out in the present Curtiss plants. The close inspection and supervision which can be furnished to this manufacturing by the Curtiss organization would add all that would be necessary to Willys-Overland equipment for this work.

"In the plane end of the industry, co-operation may be expected by the Curtiss people from the wood-working shops of the Willys-Overland, and possibly also in many other departments such as aluminum castings, small metal parts, drop forging, etc. These are all items that are now bought by the Curtiss organization from outside vendors. The Willys-Overland organization will possibly be regarded as a temporary source of supply during the period of high pressure due to the war in Europe, but that question involves a matter of prophecy, which is always more or less dangerous in corporation affairs."

University of Illinois to Have Aerodynanic Laboratory?

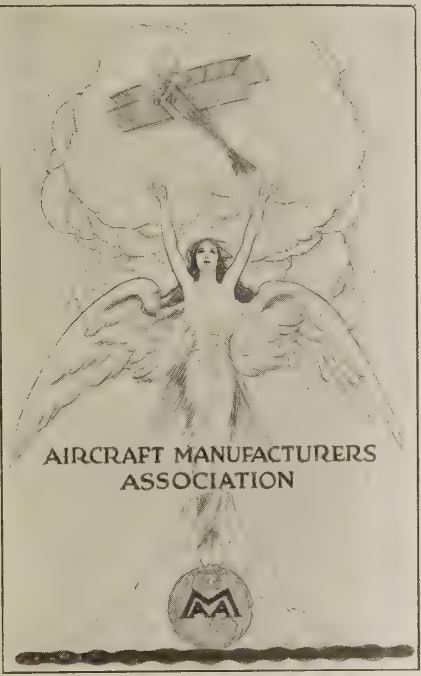
An appeal for support of a bill appropriating $150,000 for construction of an aerodynamic laboratory at the University of Illinois has been received by Chicago members of the Aero Club of Illinois from C. R. Richards, dean of the college of engineering. The appeal says:

"In view of the fact that the university has undertaken instruction in aeronautic engineering, of the tremendous possibilities for research work in this field," says the dean, "and of the great importance of advancing our knowledge of this science in the interests of national defense, the president of the university has requested that a bill be introduced in the legislature for a special appropriation of $150,000 for the erection and equipment of an aerodynamic laboratory.

"I urge, therefore, that you write to Gov. Frank O. Lowden, E. C. Curtis, chairman of the senate committee on appropriations, and E. J. Smejkal, chairman of the house committee on appropriations, and to the senators and representatives from your district expressing your belief that the state should support the university in its efforts to secure an aerodynamic laboratory."

Balloon Ascensions at Ft. Omaha

During the week of June 9, five free ascensions were made, the largest covering 126 miles. The largest in point of duration was one lasting over 6 hours. Major Henry B. Hersey, Signal Corps, U. S. R., has been assigned to active duty at the Post, and is temporarily in command, Major Lahm, the commanding officer having met with an accident while riding horseback.



The insignia adopted by the Aircraft Manufacturers Association.

Aircraft Manufacturers Association Adopt Insignia

At the recent meeting of the A. M. A. these trade marks were adopted. The wings indicate the flight which has been attained by man. The circle surrounding the star is similar to the symbol now painted on all the aircraft of the U. S. machines flying over the western front. It is a fitting and graphic symbolization of the conquest of the air.

This beautiful design was gotten up to indicate the development of the aeroplane. The earth is represented at the feet of the Spirit of Science, which is rising up through the air to infinite heights. Far above in the clouds is the aeroplane, ascending to even greater heights. Nothing could be more inspiring to man than this reaching aloft to higher things. Indeed, Oliver Wendell Holmes's famous verses might well fit this poetic conception:

"Build thee more stately mansions, Oh my soul!
As the swift seasons roll,
Leave thy low-vaulted past
Let each new temple—nobler than the last—
Shut thee from heaven, with a dome more vast,
Till thou at last are free,
Leaving thy outgrown shell by life's unresting sea!"

School of "Camouflage"

Prof. W. A. Booring of the Columbia School of Architecture is getting up a school of "camouflage" (concealing of troops) in connection with Camp Columbia, the military camp of the university, in Connecticut. Cost of course, $75; time, about six weeks, starting July 16.

Du Pont School in Operation

Wilmington, Del.—The du Pont Aviation School, on the estate of John J. Raskob, at Claymont, Del., a few miles north of Wilmington, has begun operations. The first class of students, consisting of twenty-five men, has been chosen and ten of them have already reported on the ground and are receiving practical instructions. The location of the school is ideal. The field lies along the river, is perfectly flat and offers splendid facilities for training both in ordinary machines and in hydroaeroplanes. It is under the supervision of Harry N. Atwood. The students begin their instructions at 4 o'clock in the morning and actual flying tests continue until 8. At 4 o'clock in the afternoon they begin again and the rattle of airships' motors can be heard until darkness sets in. They are being trained as pilots for Uncle Sam's flying squadrons and expect to go direct into the government service on leaving the school.

All the students on the ground now are young college men, four of them being members of the 1920 Class at Yale. The Yale men are: Thomas E. Colleton, Yale '20, of Michigan; Edward McTernan, Yale '19, Sheffield, Brooklyn, N. Y.; Ralph Talbott, Yale '20, Massachusetts; Milton E. Bacon, Yale '20, Michigan; Harvey S. Reed, Yale '20, Reading, Pa.; Fairfax Gouverneur, Exeter '17, North Carolina; Russell P. Brewer, Delaware; Philip G. Darling, Harold A. Jones and Allan O. Smith. McTernan and Talbot were members of the Freshman track team and Reed was its captain. Gouverneur served on the Mexican border when the National Guard was recently called out and now is on a furlough to attend the aviation school.

The New Duesenberg Factory at Elizabeth, N. J.

The new factory of the Duesenberg Motors Corporation in which will be built their aeroplane and automobile motors, has been under construction since the second week in May and the first section is to be completed and ready for occupancy in the third week in August.

Nine and one-half acres of ground have been obtained by the corporation. The first section here illustrated, which is now under construction, is 500 feet long by 180 feet wide. As soon as this first section is completed, a second addition of exactly the same size and formation will be built.

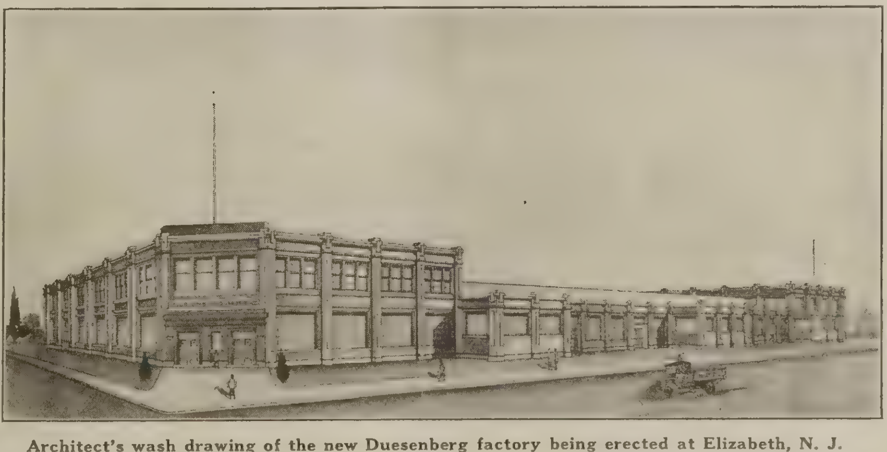
The new plant is within two minutes walk from the North Elizabeth station directly on the Pennsylvania Railroad and everybody going to and from Philadelphia, Washington, etc., will see the big new plant and the huge electric sign now being erected.

The building is of the latest brick, steel and glass construction with wood block floors to make it easier on the workmen's feet. The forward part of the building is a two-story proposition, the upper half of which will be used for the general office of the corporation, although the sales organization will continue to maintain its headquarters at 120 Broadway, New York City. The further end of the building is also a two-story proposition, as this will be used as a test room and a large traveling crane will be installed for quickly and efficiently transporting the motors from the end of the assembly aisles to the testing blocks. The plant proper is a single story building with saw-tooth roof construction.

The Duesenberg Motors Corporation have set out to make this the most complete and efficient motor manufacturing plant in the country today. Modern systems of progressive manufacture will be adopted and it is assured that big production will be possible within a very short time after actual occupation of the building.

The necessary machinery for this plant has already been purchased and is now in the actual possession of the corporation waiting to be installed on the floor of the new factory.

The immediate work of this new factory will be to turn out a quantity of the four-cylinder sixteen-valve Duesenberg aeroplane motor, which has created such a reputation for itself in actual service during the past few months.



Architect's wash drawing of the new Duesenberg factory being erected at Elizabeth, N. J.

DETAILS OF GERMAN AVIATION ENGINES

By E. H. SHERBONDY, Engineering Department, Peerless Motor Car Co.

EDITOR'S NOTE:—*The paper which follows is a combination of the formal printed pieces of the paper presented to the Cleveland Section of the S. A. E. together with the expanded notes presented in the June* 21 *issue of our contemporary, "The Automobile."*

IN October, 1909, Farman succeeded in flying 3 hr. 4 min. with a Gnome motor. It was this year that Glenn Curtiss went to France and astounded the world by carrying off the Gordon Bennett Cup with a Curtiss biplane driven by a Curtiss engine 3¾-in. bore and 3¾-in. stroke. This motor is said to have weighed 200 lbs. and gave 35 h.p. at 1000 r.p.m. It was also in 1909 that Louis Bleriot succeeded in flying across the channel in a Bleriot monoplane driven by a three-cylinder 25-h.p. Anzani motor. The flight was made in barely ½ hr. and it was immediately after this flight that the British War Office first became interested in the military possibilities of heavier than air machines. Shortly after this Lord Northcliffe organized the Daily Mail Contest Prize, which was $25,000 and was won by Col. Cody for a flight from London to Manchester. From this time on considerable interest in aviation was manifest in all European countries and each of the various governments took it upon itself to not only investigate the military possibilities of aviation but also afforded substantial support to the builders of aeroplanes and aeroplane motors. This is particularly true of Germany, where in 1913 there was organized the Kaiser Prize Contest for the best aviation motor that could be developed. In addition to prize contests, substantial subsidies were arranged for firms capable of building aviation motors, and this not only stimulated but made possible the development of such motors as the Mercedes and Benz in Germany.

Size and Speed Increase

The size of the planes and the speed have increased by leaps and bounds during the period of the war. The facility with which man now flies is almost equal to that of birds. The largest sized successful aeroplane motor built up to 1909 was the 100-h.p. Antoinette. This year planes have been flown with a total of 1700 h.p.

It was my good fortune to secure from Baron Charles Huard two of the aviation motors which were shot down in France during the last year. These motors I have had dismantled and am now able to give the full particulars of 170-h.p. Benz and another motor of the Mercedes type, which is a twin six and which was probably built by Renault.

The 150-h.p. six-cylinder Mercedes motor is 140-mm. bore and 160-mm. stroke. This type of motor won all the important places in the Kaiser prize contest with the exception of the first prize, which went to the Benz. The Mercedes company started with smaller cylinders, namely, 100-mm. bore and 140-mm. stroke, six cylinders. The principal features of the design are forged steel cylinders with forged steel elbows for gas passages, pressed steel water jackets, which when welded together forms the cylinder assembly, the use of inclined overhead valves operated by means of an overhead camshaft through rocker arms which multiply the motion of the cam. By the use of steel cylinders, not only is the weight greatly reduced but certain liability to distortion through unequal sections, leaks and cracks is entirely avoided. The construction is necessarily very expensive. It is certainly a sound job. In the details of this construction there are a number of important things, such as finished gas passages, water-cooled valve guides and a very small mass of metal which is water-cooled surrounding the spark plug. Of course, it is necessry to use very high compression in aviation motors in order to secure high power and economy and, owing to the fact that aviation motors are worked at nearly their maximum, the heat flow through the cylinder, piston and valves is many times higher than that encountered in automobile motors. It has been found necessary to develop special types of pistons to carry the heat from the center of the head in order to prevent pre-ignition.

Forged Steel Piston Heads

In the Mercedes motor the pistons have a drop-forged steel head which includes the piston pin boss; this head is screwed to a cast iron skirt which has been machined inside to secure uniform wall thickness.

The carbureter used on this 150-h.p. Mercedes motor is precisely of the same type used on the twin six motor which I shall hereafter describe. It has two venturi throats, in the center of which is placed the gasoline spray nozzle of conventional type, fixed size orifices, immediately above which are placed two panel type throttles with side outlets. An idling or primary nozzle is arranged to discharge above the top of the venturi throat. The carbureter body is of cast aluminum and is water jacketed. It is bolted directly to air passage passing through the top and bottom half of the crankcase, which passes down through the oil reservoir. The air before reaching the carbureter proper has to some extent cooled the oil in the crank chamber and has itself been heated to assist in the vaporization. The inlet pipes themselves are copper. All the passages between the venturi throat and the inlet valve have been carefully finished and polished. The only abnormal thing in the design of this motor is the short connecting-rod which is considerably less than twice the stroke and would be considered very bad practice in motor car engines. A short connecting-rod, however, possesses two very real virtues, in that it cuts down height of the motor and the piston passes over the bottom dead center much more slowly than with a long rod.

Other features of the design are a very stiff crankcase, both halves of which are bolted together by means of long through bolts, the crankshaft main bearings are seated in the lower half of the case instead of in the usual caps and no provision is made for taking up the main bearings. The Mercedes company uses a plunger type of pump having mechanically operated piston valves and it is driven by means of worm gearing.

Light Camshaft Construction

The overhead camshaft construction is extremely light. The camshaft is mounted in a nearly cylindrical cast bronze case and is driven by means of bevel gears from the crankshaft. The vertical bevel gear shaft through which the drive is taken from the crankshaft to the camshaft operates at one and one-half times the crankshaft speed and the reduction to the half time camshaft is secured through a pair of bevels. On this vertical shaft there is mounted the water pump and a bevel gear for driving two magnetos. The water pump mounted on this shaft tends to steady the drive and avoid vibration in the gearing.

The following are the cylinder sizes of six-cylinder aviation motors which have been built by Mercedes:

Bore, mm.	Stroke, mm.	H.P.
105	140	100
120	140	135
140	150	150
140	160	160

The largest of these motors, last on the table above, has recently had its power increased to 176 h.p. at 1450 r.p.m. This general design of motor has been the foundation for a great many other aviation motor designs, some of which have proved very successful but none of which, in the writer's estimation, are equal to the original. Among the motors which follow more or less closely the scheme of design and arrangement are the Hall-Scott, Wisconsin, Renault, Packard, Christofferson and Rolls-Royce. Each of these motors shows considerable variation in detail. The Rolls-Royce and Renault are the only ones which have used the steel cylinder with the steel jacket. The Wisconsin motor uses an aluminum cylinder with a hardened steel liner and cast iron valve seats. The Christofferson has somewhat similar design to the Wisconsin with the exception that the valve seats are threaded into the aluminum jacket and the cylinder head has a blank end which is secured to the aluminum casting by means of the valve seat pieces. The Rolls-Royce motors show small differences in details of design in cylinder head and camshaft housing from the Mercedes, on which they have taken out patents, not only abroad but in this country.

The Renault Motor

The V-type twin-six Renault motor is 125 mm. bore and 160 mm. stroke. The first important peculiarity of this design is a small angle between the cylinders which is only 47½ deg., and enables the fuselage to be considerably narrowed in width, thus reducing the head resistance. The cylinders of this motor are almost a duplicate of the Mercedes design of steel cylinder with the exception that the elbows in which the valves are inserted are not so carefully designed and the water jacket is carried around only one side of the exhaust valve stem, whereas in the Mercedes motor the water jacket completely surrounds the exhaust valve stem. It appears to be absolutely essential to cool the exhaust valve as much as possible, since pre-ignition is likely to occur always from one of three sources, the spark plug, which is the arch offender, the exhaust valve or the center of the piston head. There are two valves for a cylinder only 66 mm. or about 2⅝ in. in diameter. The valve port is 61 mm. or 2 13-32 in. The inlet to the elbow is 53 mm. in diameter. The valve stems are both 11 mm. or 7-16 in. diameter, with a head approximately 5-32 in. thick and a 45 deg. angle seat ⅛ in. wide.

Wide Valve Seats Essential

It is important in aviation motors to have considerable width of seat, as it greatly assists in carrying the heat off the exhaust valve. The end of the valve stem is threaded to carry the spring cup and lock nut. Each of the cylinder bands together with the head is machined from a forged bar, after which the intake and exhaust elbows are welded on and finally the pair of cylinders are encased in a jacket which is welded up from three pieces of steel approximately 1-32 in. thick. The cylinder walls themselves are 3 mm. or 7-64 in. thick. A standard two-bolt flange is used for all intake and exhaust port connections and has been profile milled out of steel. The flanges are screwed on to the cylinders and welded and brazed on to the intake and exhaust pipes.

The pistons are of cast iron and are the only very heavily designed pieces in the motor, and it certainly seems as though these could have been considerably lightened. The piston carries three concentric rings which are pinned at the ring gap and have a deep annular rib between the bosses. The pistons are also unusually short, only 95 mm. in length. Piston pin is 38 mm. in diameter and has a ⅛-in. wall and is locked with a single set screw and cotter pin. There are eighteen 11-32 in. holes drilled into the skirt, but these holes must have been drilled for oiling purposes, as they do not materially reduce the weight of the piston.

The connecting-rods are of the articulated type and the short rod is alternately arranged from right to left cylinder from the front of the motor to the back.

The connecting-rods are made of B. N. D. steel I-beam section with a flange and web of 2 mm. thickness. The flanges are 26 mm. and the web is 34 mm. wide. In the short connecting-rod both ends of the rod are alike. The length of the rod is 300 mm. or 11 13-16 in. The rod cap is secured by means of three bolts, two 11 mm. in diameter and one of 14 mm. in diameter.

Crankshaft Carried in Four Bronze Shells

The crankshaft is carried in four babbitt-lined bronze shells, which in turn are secured to ribbed steel bearing caps. The bearing caps are locked in the top of case by means of long U-bolts, such as are sometimes used on automobile spring saddles. The crankshaft has a diameter of 60 mm. with the exception of the propeller shaft end, where the diameter is increased to 68 mm. The crankpins and main bearings are 72½ mm. long with the exception of the bearing in propeller end, which is 92 mm. long. The shaft is drilled out for lightness, but oil is carried from the main bearings by means of thrower rings and separate small steel pipes to the connecting-rod big ends. The front end of the crankshaft is splined to mount the starting gear and accessory drive. The water pump is mounted on the front of the motor from the bottom half of the crank chamber, and has an ingeniously designed double runner with double collecting chambers. The water is piped to either side of the motor; though copper pipes and rubber connections are interposed to prevent cracking joints due to vibration.

The carbureter only differs from the Mercedes in that it uses a single float chamber instead of two float chambers. There are two carbureters mounted on either side of the motor bolted to either side of the crankcase by means of long studs and the intake pipes, which are fastened by means of unions to the carbureter, are made of copper tubing, 48 mm. in diameter.

The carbureter has a pair of primary nozzles and a pair of secondary nozzles and an auxiliary air valve which consists of an annular ring mounted concentric with centuri throat. It would seem that this auxiliary air valve was as dangerous construction to go up in the air with, as it is very likely to stick.

Oil is carried through cast ducts in the front and rear compartments of the crank chamber to the main bearings. It is also carried from these ducts through two copper tubes up to the overhead camcase and passes through the camshaft case from the propeller to the starting end of the motor and returns down through the distributing gearing case to the oil sump.

The valve gear is of very elaborate, expensive design. The main scheme of the construction is to use a light steel tube, carried on the studs from the cylinder head, which is slotted to take bronze cages which form both the camshaft bearings and rocker arm mountings. The rocker arms are arranged to multiply the cam motion so that the valve opens 12 mm. The camshafts are driven through straight bevel gears and the driving shaft driven through straight bevel gears of 12½ mm. face three module pitch, and the inclined shafts which drive the camshafts operate at three times camshaft speed. The high speed of these shafts and the resultant lowering in torque on them allow their weight to be considerably decreased.

Gearing Cheap and Light

At first sight it would seem that the construction of gearing in the Renault motor is a very complicated and expensive one, but this arrangement turns out cheaper and very much lighter than where a train of spur gears is used for driving magnetos, camshafts, etc. The Peugeot company introduced the use of spur gears for overhead camshaft driving and this construction has been copied by Sunbeam, Wisconsin and Packard. In a twin six, or an eighteen-cylinder motor, the number of gears necessary with this gearing arrangement forms a maze of complications. The Rolls-Royce, Hispano-Suiza, Hall-Scott and Chistofferson used bevel gears for driving the camshaft. All these designs are more or less an imitation of the original Mercedes. A few of the imitators seem to have grasped the importance of operating the auxiliary shaft of the magneto driving arrangements. There are four magnetos mounted on the same axis, each pair being driven through a spur gear, which in turn meshes with a spur gear which is slidably mounted on a splined magneto driveshaft. The magneto driveshaft terminates at its forward end in the sleeve of a bevel gear and is helically splined into the bevel gear so that when longitudinally displaced the shaft is also angularly displaced. This construction is quite costly but is the best one the writer has seen, since it avoids a lot of connections to magneto breaker boxes and it also insures a spark of the same intensity regardless of whether the ignition is advanced or retarded.

At the front end of the crankshaft there is mounted an aluminum six-cylinder air starting motor which engages the crankshaft by means of an overrunning clutch. This air starting motor has a single inlet discharge valve for six cylinders of the rotating disk type. There is also built integral with this starter a hand starting gear and the starting magneto drive.

The Benz Motor

In the Kaiser prize contest for aviation motors a four cylinder Benz motor of 130 by 180 mm. won first prize, developing 103 b.h.p. at 1290 r.p.m. The fuel consumption was 210 grams per horsepower hour. Total weight of the motor was 153 kilograms. The oil consumption was .02 of a kilogram per horsepower hour. This motor was afterward expanded into a six-cylinder design and three different sizes were built.

The accompanying table gives some of the details of weight, horsepower, etc.

Motor type	B	FD	FF
Rated horsepower	85	100	150
Horsepower at 1250 r.p.m.	88	108	150
Horsepower at 1350 r.p.m.	95	115	160
Bore in millimeters......	106	116	130
Stroke in millimeters....	150	160	180
Offset of the cylinders in millimeters	18	20	20
Rate of gasoline consumption in grams.........	240	230	225
Oil consumption in grams per b.h.p. hour........	10	10	10
Oil capacity in kilograms	36	4	4½
Water capacity in litres..	5½	7½	9½
The weight with water and oil but with two magnetos, fuel feeder and air pump in kiograms..	170	200	245
The weight of motors, including the water pump, two magnetos, double ignition, etc...........	160	190	230
The weight of the exhaust pipe complete in kilograms	4	4.8	5½
The weight of the propeller hub in kiograms...	3½	4	4

The Benz cylinder is a simple, straightforward design and a very reliable construction and not particularly difficult to manufacture. The cylinder is cast of iron without a water jacket but including 45-deg. angle elbows to the valve ports. The cylinders are machined wherever possible and at other points have been hand filed and scraped, after which a jacket, which is pressed in two halves, is gas welded by means of short pipes welded on to the jacket. The bottom and the top of the cylinders become water galleries, and by this means separate water pipes with their attendant weight and complication are eliminated. Rubber rings held in alluminum clamps serve to connect the cylinders together. The whole construction turns out very neat and light. The cylinder walls are 4mm. or 3/16 in. thick and the combustion chamber is of cylindrical pancake form and is 140 mm. or 5½ in. in diameter. The valve seats are 68 mm. in diameter and the valve port is 62 mm. in diameter.

Valve Stems in Two Diameters

The passage joining the port is 57 mm. in diameter. In order to insert the valves into the cylinder the valve stem is made with two diameters and the valve has to be cocked to insert it in the guide, which has a bronze bushing at its upper end to compensate for the smaller valve stem diameter. The valve stem is 14 mm. or 9/16 in. in diameter and is reduced at its upper portion to 9½ mm. The valves are operated through a push rod and rocker arm construction, which is 7-16 in. and exceedingly light. Rocker arm supports are steel studs with enlarged heads to take a double row ball bearing. A roller is mounted at one end of the rocker arm to impinge on the end of the valve stem, and the rocker arm has an adjustable globe stud at the other end. The push rods are light steel tubes with a wall thickness of 0.75 mm. and have a hardened steel cup at their upper end to engage the rocker arm globe stud and a hardened steel globe at their lower end to socket in the roller plunger.

The Benz camshaft has a diameter of 26 mm. and is bored straight through 18 mm. and there is a spiral gear made integrally with the shaft in about the center of its length for driving the oil pump gear. The cam faces are 10 mm. wide. There is also, in addition to the intake and exhaust cams, a set of half compression cams. The shaft is moved longitudinally in its bearings by means of an eccentric to put these cams into action. At the fore end of the shaft is a driving gear flange which is very small in diameter and very thin. The flange is 68 mm. in diameter and 4 mm. thick and is tapped to take 6 mm. bolts. The total length of camshaft is 1038 mm., and it becomes a regular gun boring job to drill a hole of this length.

The camshaft gear is 140 mm. or 5½ in. outside diameter. It has fifty-four teeth and the gear face is 15 mm. or 19-32 in. The flange and web have an average thickness of 4 mm. or 5/32 in. and the web is drilled full of holes interposed between the spur gear mounted on the camshaft and the camshaft gear. There is a gear which serves to dirve the magnetos and tachometer, also the air pump. The shaft is made integrally with this gear and has an eccentric portion against which the air pump roll plunger impinges.

Crankshaft Has Beautiful Finish

The seven-bearing crankshaft is finished all over in a beautiful manner, and the shaft out of the particular motor we have shows no signs of wear whatever. The crankpins are 55 mm. in diameter and 69 mm. long. Through both the crankpin and main bearings there is drilled a 28-mm. hole, and the crank cheeks are plugged with solder. The crank cheeks are also built to convey the lubricant to the crankpins. At the fore end of the crank cheek there is pressed on a spur driving gear. There is screwed on to the front end of the shaft a piece which forms a bevel water pump driving gear and the starting dog. At the rear end of the shaft very close to the propeller hub mounting there is a double thrust bearing to take the propeller thrust.

Long, shouldered studs are screwed into the top half of the crankcase portion of the case and pass clean through the bottom half of the case. The case is very stiff and well ribbed. The three center bearing diaphragms have double walls. The center one serves as a duct through which water pipe passes, and those on either side of the center form the carbureter intake air passages and are enlarged in section at one side to take the carbureter barrel throttle.

The pistons are of cast iron and carry three concentric rings ¼ in. wide on their upper end, which are pinned at the joint. The top of the piston forms the frustum of the cone and the pistons are 110 mm. in length. The lower portion of the skirt is machined inside and has a wall thickness of 1 mm. Riveted to the piston head is a conical diaphragm which contacts with the piston pin when in place and serves to carry the heat off the center of the piston.

The oil pump assembly comprises a pair of plunger pumps which draw oil from a separate outside pump, and constructed integrally with it is a gear pump which delivers the oil under about 60 lb. pressure through a set of copper pipes in the base to the main bearings. The plunger oil pump shows great refinement of detail. A worm wheel and two eccentrics are machined up out of one piece and serve to operate the plungers.

Sunbeam Aviation Motor

Since 1914 the Sunbeam company has produced engines of six, eight, twelve and eighteen cylinders from 150 to 500 hp. with both iron and aluminum cylinders. For the last 2 years all the motors have had overhead camshafts with a separate shaft for operating the intake and exhaust valves. Camshafts are connected through to the crankshaft by means of a train of spur gears, all of which are mounted on two double-row ball bearings. In the twin six, 350-hp. engine, operating at 2100 r.p.m., it requires about 4 hp. to operate the camshafts. This motor gives 362 h.p. at 2,100 revolutions and has a fuel consumption of 51/100 of a pint per brake horsepower hour. The cylinders are 110 by 160 mm. The same design has been expanded into an eighteen-cylinder, which gives 525 hp. at 2,100 turns. There has also been developed a very successful eight-cylinder motor rated at 220 hp., which has a bore and stroke of 120 by 130 mm., weight 450 lb. This motor is an aluminum block construction with steel sleeves inserted. Three valves are operated, one for the inlet and two for the exhaust. One camshaft operates the three valves. This motor is very successful, and besides being built by the Sunbeam company is also being produced by the Austin Motor Company.

The modern Sunbeam engines operate with a mean effective pressure of 135 lb. with a compression ratio of 6 to 1. The connecting-rods are of the articulated type, as in the Renault motor, and are very short. The weight of these motors turns out at 2.6 lb. per b.hp., and they are able to go through a 100-hr. test without trouble of any kind. The lubricating system comprises a dry base and oil pump for drawing the oil off from the base, whence it is delivered to the filter and cooling system.

It then is pumped by a separate high pressure gear pump through the entire motor. In these larger European motors castor oil is used largely for lubrication. It is said that without the use of castor oil it is impossible to hold full power for five hours. Coatalen favors aluminum cylinders rather than cast iron.

Curtiss Motors

The Curtiss OX motor has eight cylinders, 4 by 5 in., delivers 90 hp. at 1,400 turns, and the weight turns out at 4.17 lb. per horsepower. This motor has cast-iron cylinders with monel metal jackets, overhead inclined valves operated by means of two rocker arms, push and pull rods from the central camshaft located in the crankcase. The cam and push rod design is extremely ingenious and the whole valve construction turns out very light. This motor is an evolution from the early Curtiss type motor which was used by Glenn Curtiss when he won the Gordon Bennett Cup at Rheims. A slightly larger edition of this type motor is the OXX, which has cylinders 4¼ by 5, delivers 100 hp. at 1,400 turns and has the same fuel and oil consumption as the OX type motor, namely, 0.6 lb. of fuel per b.hp. hour and 0.03 lb. of lubricating oil. The Curtiss company has developed in the last 2 years a larger sized motor, now known as the V-2, which was originally rated at 160 hp. and which has since been refined and improved so that the motor gives 220 hp. at 1,400 turns, with a fuel consumption of 52/100 lb. per b.hp. hour and an oil consumption of 0.03 lb. per b.hp. hour. This larger motor has a weight of 3.45 lb. per horsepower and is now said to be giving very satisfactory service. This V-2 motor has drawn steel cylinders with a steel water jacket top and a monel metal cylindrical jacket, both of which are brazed on to the cylinder barrel itself. Both these motors use side by side connecting-rods and fully forced lubrication. The camshafts act as a gallery from which the oil is distributed to the camshaft bearings, the main crankshaft bearings and the gearing. Here again we find extremely short rods, which, as before mentioned, enable the height and the consequent weight of construction to be very much reduced. For ordinary flying at altitudes of 5,000 to 6,000 ft., the motors are sent out with an aluminum liner, bolted between the cylinder and the crankcase in order to give a compression ratio which does not result in pre-ignition at a low altitude. For high flying, however, these aluminum liners are taken out and the compression volume is decreased to about 18.6 per cent of the total volume.

Austro-Daimler Engines

One of the first very successful European flying engines which was developed in Europe is the Austro-Daimler, which was built after the designs of Herr Porsche. The first of these motors had four cylinders, 120 by 140 mm., with cast iron cylinders, overhead valves operated by means of a single rocker arm, controlled by two cams, and the valves were closed by a single leaf spring which oscillates with the rocker arm. The cylinders are cast singly and have either copper or steel jackets applied to them. The four-cylinder design was afterwards expanded into the six-cylinder design, and still later a six-cylinder motor of 130 by 175 mm. was developed. The rights to construct this engine in Great Britain and the Colonies were secured by William Beardmore & Son, of Glasgow, Scotland. The engine is also being built by T. C. Pullinger and Arrol Johnston, of Dumfries, Scotland. This motor uses an offset crankshaft, as does the Benz motor, and the effect of offset will be discussed later on in this paper.

The lubrication also is different from any other aviation motor, since individual high pressure metering pumps are used to deliver fresh oil only to the bearings and cylinders, as was the custom in automobile practice some 10 years ago.

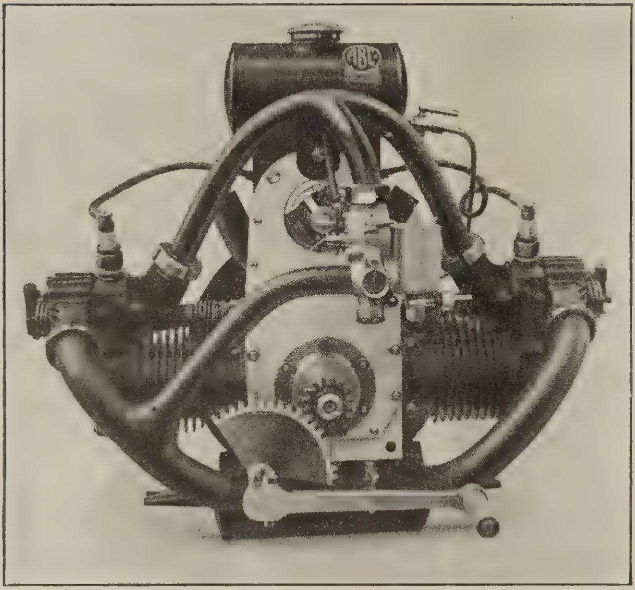
Two of the motors described, the Benz and Austro-Daimler motor, use the offset crankshaft construction, and this has for a long time been quite common in German and Belgian mo-

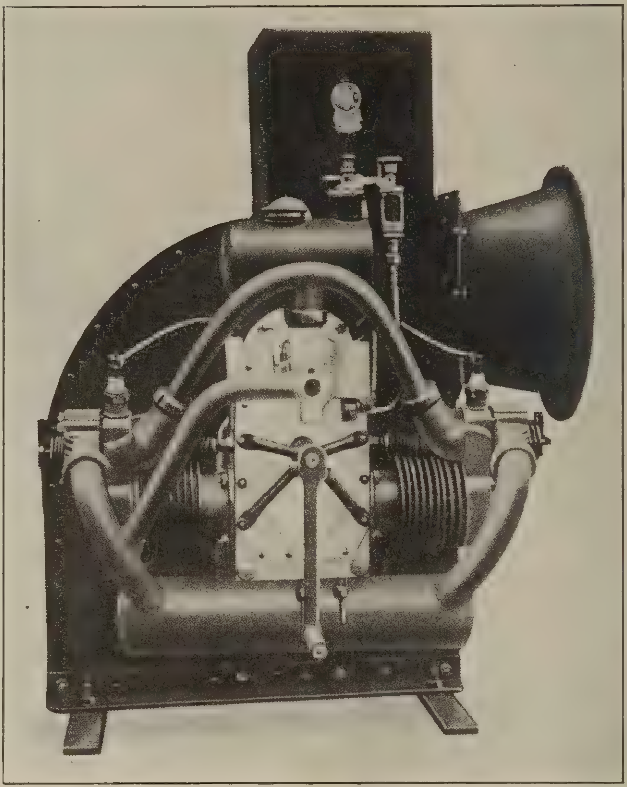
(*Continued on page 532*)

A. B. C. AUXILIARY MOTORS

THE question of the employment of auxiliary power plant for certain purposes on aeroplanes has had consideration for a considerable period, because there are many functions which may be performed by such a contrivance in operating minor mechanical units on an aeroplane more effectually than by the use of the main power plant for all purposes.

For instance, it is no secret that wireless telegraphy is employed on many aeroplanes, and it is an equally obvious fact that the electric current required cannot be usefully generated by hand, nor conveniently carried in storage batteries.





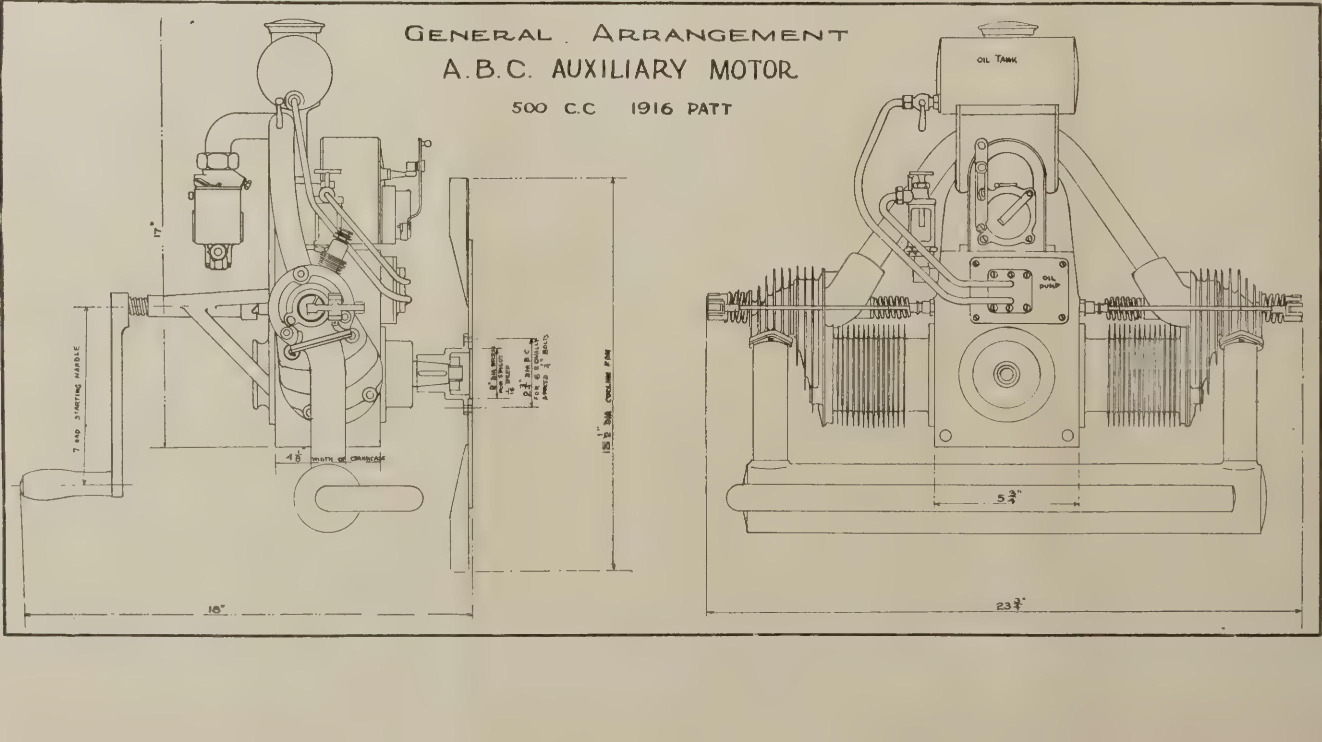
The more immediately obvious method is to drive the dynamo from the engine of the aeroplane, but the disadvantage of this procedure is that it robs the machine of locomotive power which often can ill be spared, and it throws the whole apparatus out of use should the machine be compelled to alight upon land or water in the event of engine failure.

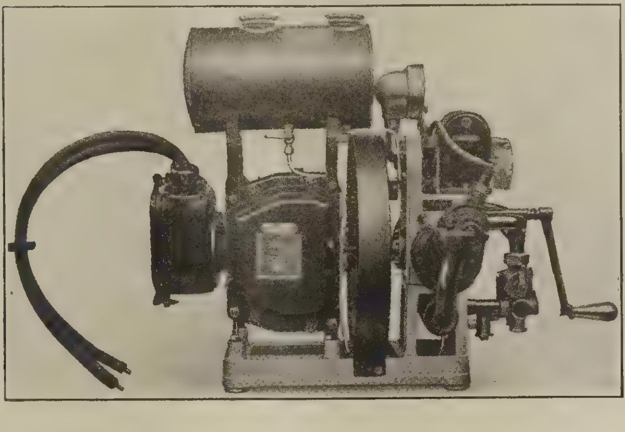
Other aeroplanes may find it necessary to use electric lights of considerable power, either for the purpose of signaling or as aids in landing, and here again it is conceivably possible that a light dynamo might be driven from the main power plant.

Again, the task of starting up an engine of large size is something of a problem. On aeroplanes where engines up to 100 h.p. are concerned, the primitive method of turning the propeller over manually is merely inconvenient. In the bigger motors, however, it becomes virtually an impossibility and auxiliary means have perforce to be employed. One method is a suitably geared starting handle which can be operated from the interior of the aeroplane, the second is by the use of a compressed air bottle, and lastly by the employment of an auxiliary engine.

For the three several purposes enumerated above it must be borne in mind that the auxiliary engine is extraneous to the flying of the aeroplane, and its presence must hamper the flying performance of the machine as little as possible. Thus the great desiderata are compactness and lightness, and this leads one naturally to the adoption of a small internal combustion engine.

One of the most successful power plants of this description has been produced by the A. B. C. Road Motors (1914), Ltd.,





of Hersham, Walton-on-Thames, England. This little engine is a twin horizontally opposed, air-cooled motor, built primarily for lightness and power.

A. B. C. AUXILIARY MOTORS are made in two sizes, and their sphere of usefulness now extends to almost every branch of the service as well as hundreds of different departments in civilian life.

Both engines are of the twin cylinder horizontally opposed type and they are air cooled.

The smaller engine is of 250 cubic centimetres cylinder capacity, having a bore and stroke of 60 mm. by 44 mm., and the power developed is 2 b.h.p. for continuous running, and up to 3 b.h.p. for runs of comparatively short duration. A maximum of 4 b.h.p. for shorter periods can be obtained from this engine, and it can be run continuously at anything from 1,200 to 3,600 revolutions per minute.

The weight of the engine is 14 lbs., but fitted with magneto, carburetor and pipes the weight is 26 lbs.

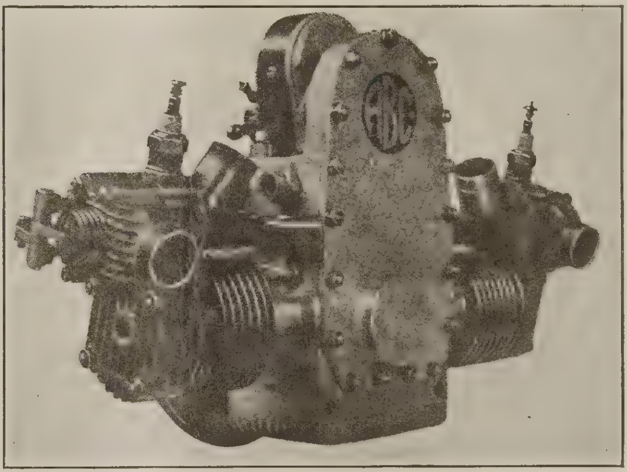
The engine has been designed with a view to the greatest simplicity possible, and has relatively very few working parts, and, with the exception of the connecting rod small ends, every bearing is of the ball or roller type. The crankshaft is of high tensile steel machined in one piece, and the connecting rod big ends are roller bearing. The connecting rods are in one piece without joints or screws, and the whole of the inside parts of the engine are accessible by removing one cover plate. The cylinders are machined from solid steel, and are provided with cast-iron heads. The pistons are of cast-iron, which is an advantage, owing to the slightly higher coefficient of expansion of steel as compared with that of iron, the result of being that the piston is always left free and seizure is practically impossible. The cylinder heads are of cast-iron, and are held on to the cylinders by means of four studs. The joint between the cylinder heads and the cylinder itself is very broad and leakage at this place is almost impossible, although the cylinder head is easily removable for cleaning. The valves are super-imposed, that is to say, the inlet is a side valve and the exhaust is an overhead valve immediately over the inlet. This has the result of assisting to cool the engine, as the exhaust valve and dome are isolated as much as possible from the cylinders proper, and the cool induction gases sweep the exhaust valve head and assist to cool it, besides materially improving carburetion.

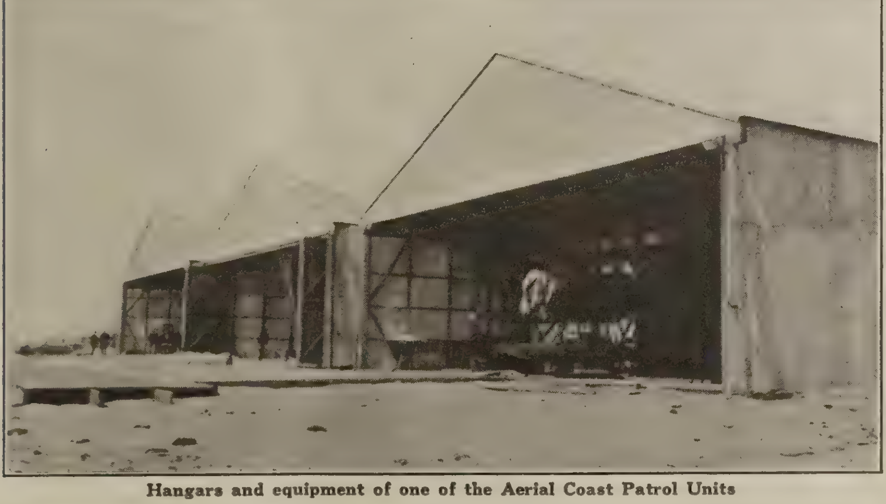
Should an inlet or exhaust valve break, a very rare occurrence, it is impossible for the head to fall into the cylinder. The exhaust done is detachable, and can be removed in a few moments by undoing four nuts. There is one camshaft cut from the solid and one inlet and one exhaust cam to operate the two cylinders, giving perfect synchronization and even running. The tappets are operated through hanging links, and the whole of the wearing parts are made glass hard to prevent wear.

The carburetor is a small Claudel Hobson automatic, with one lever only, which gives extremely fine results. The engine can be throttled down to 200 r.p.m., and will run indefinitely at this speed.

A small lubricating tank is fitted on top of the crank case with sight-feed drip lubrication which can be regulated to the correct amount of oil.

As a proof of the perfect balance of the motor, the makers claim that it can be carried in the hands whilst running at 4,000 r.p.m., when it develops in the neighborhood of 6 h.p., which is little short of marvelous when the weight of the complete unit, including magneto, carburetor, induction and exhaust pipes, flywheel, starting lever, flexible coupling, and all wires and connections totals 59 lbs. In addition to the uses already set forth work could be found for this motor as a starter for airship engines, as a power unit for portable wireless field sets, for driving blowers for airship ballonets, and for various kinds of light duty on the ground.





Hangars and equipment of one of the Aerial Coast Patrol Units

Plattsburg Airmen First

Plattsburg, N. Y.—Men in training at this camp will form the first squadron of a giant army of American airmen, it has been announced.

Following the statement of Lieutenant-Colonel Wolf that orders had been received from the War Department to utilize all the men in training here, it was declared that a large, though as yet undetermined percentage will be selected as aviators.

A week ago it was declared that approximately 25 per cent. of the men would be discharged before the end of the course. Forty-five men were to be picked from each company for active service and the rest held in reserve. The new ruling assures every man here of a place in some branch of the army service.

Summer Courses at Wisconsin University

The nineteenth annual Summer Session of the College of Engineering of the University of Wisconsin will be held at Madison during the six weeks' period beginning June 25, 1917.

Special courses will be given in Chemistry, Electrical, Steam, and Hydraulic Engineering, Gas Engines, Machine Design, Mechanical Drawing, Mechanics, Shop Work, and Surveying. All courses given in the University Summer Session are open to engineering students.

Special courses have been arranged for engineering, manual arts, and vocational teachers.

For information, address F. E. Turneaure, Dean, Madison, Wisconsin.

STEELS USED IN AERO WORK*

By Dr. W. H. HATFIELD
(Brown-Firth Research Laboratory, Sheffield)

Introduction

MY lecture deals with the uses of steel in aeronautics, and I propose to commence by indicating two essentials:

(1) The use of high-class material.
(2) Scientific methods in works practice.

High quality not only influences the composition of the final steel, but also directly influences the method of production. To begin with, it is undesirable in special alloy steels that the sulphur and phosphorus should exceed relatively low limits; particularly does this apply to sulphur, since any sulphur which is present is present not really *in* the steel, but as sulphide of manganese "mixed" with it as a separate non-metallic inclusion readily observed by the microscope, and these non-metallic inclusions, *i.e.*, sulphides, slag, etc., have quite a serious influence under particular circumstances.

If engineers responsible for the building of aeroplanes, aero engines, etc., are to obtain anything like the best results from the materials which are now available, it is necessary that they shall have some appreciation of the characteristics and properties of those steels. They should understand the reason for the various heat treatments, and should also appreciate the considerations which lead to the selection of any particular one as the means of placing the steel in the final condition in which it may be expected to do the best service. It will be apparent that accurate heat treatment, based upon the definite thermal phenomena associated with each particular steel, is essential, and this necessitates, in works practice, the use of satisfactory and properly standardized pyrometers. Having obtained satisfactory pyrometers, it is necessary to learn to use them intelligently, and I will here point out that it is not enough to know that your pyrometer gives a correct reading when placed into a certain temperature. What is still more important is that the temperature recorded truly represents the heat of the part which is being heat-treated. That brings us to a consideration of the types of furnaces which may be employed, and here again it is necessary to use the very best types and the most efficiently constructed and worked furnaces if homogeneous results are to be anticipated in the final product.

Duties of Various Parts

In deciding the class of material suitable for the various parts of any machine or structure, it is necessary to take very carefully into consideration the nature of the stresses which the parts have to withstand and the conditions under which they are called upon to work. Generally speaking, it is possible to divide them into two broad classes:

(1) Parts subjected to stresses of a known nature and of fairly determinable magnitude.

These include steady, intermittent, and alternating stresses, and the parts concerned are those which have to take up the weight of the structure or to transmit forces directly consequent upon the generation and utilization of power.

(2) Parts subjected to sudden stresses of unknown magnitude, generally described as "shocks."

In applying this method of division to aeroplanes, it would appear that, whilst the wings and framework of the machine as a whole may be subjected to stresses of the second class, such stresses can be, and are, to a large extent eliminated from the power plant. The aero engine, whether on the ground or in the air, is not liable to such sudden changes of load as a motor-car engine (owing to the fact that the engine and propeller can run at speeds not in a direct ratio to the forward velocity of the aeroplane), and, incidentally, there is the absence of change-gears. Comparatively light "shocks" are suffered by the valves, and their driving mechanism (cams, cam shafts, and tappets), and also by the valve seating.

The wheels and landing chassis, and, in a lesser degree, the fuselage and wings, are subject to shocks, although for the latter the spring suspensions transmit the forces more as live loads than as real shocks.

Returning to the parts subjected to the first class of stress, the demand made upon these is very high. Not only do the stresses fluctuate considerably, but some of the parts, such as cylinder and piston, have at the same time to withstand high temperatures as well as abrasion. All parts also have to encounter low temperatures, and as to exactly what low temperatures have to be encountered when the planes are up at high altitude in cold weather, I should like to receive information during the discussion.

It is generally accepted that parts not subjected to shock should be produced with material having essentially a high elastic limit with just sufficient ductility to ensure non-brittleness, whereas for parts subjected to severe shock toughness is the more important feature. The division between the two classes of stresses is not very sharp, and in many cases a compromise would appear to be made between the two types of material. Bearing on this, it should always be remembered that all the parts under consideration are of relatively small section and lend themselves to very careful heat treatment, and the steels are worth studying with a view to determining exactly what properties can conveniently be introduced into such sections.

In general design there is another quality which must not be lost sight of, *i.e.*, the rigidity of the parts concerned. Parts which are not subjected to very great forces, such as the crank case in a good design, must not have their dimensions so reduced as to make them very liable to change their shape. A high-tensile material in such a case is unnecessary, it being preferable to use a light alloy and increased dimensions. (Modulus of elasticity in steel varies very little indeed either by hardening, tempering, or modification of composition within the limits of those steels used.)

The "'modulus of elasticity" of the material employed is a determining factor in the question of rigidity. A lower value of the "modulus" means a greater elastic deformation under a given applied force, *i.e.*, a reduction in "stiffness," unless the dimensions are also modified. Considering, for example, a flat portion of the shell of the crank case having uniform thickness, the "stiffness" of this part to resist forces applied at right angles to it is proportional to the cube of the thickness, while its actual strength is only proportional to the square of the thickness. These laws will apply approximately to the strength and stiffness of the whole crank case.

Thus, suppose a steel casing is replaced by one of aluminum alloy of twice the thickness, and suppose the safe stress of the latter in tension is one-third of that of the steel; then taking the values of specific gravity as 7.8 and 2.8 respectively and those of Young's modulus as 14,000 and 4,700 tons per square inch respectively, a flat portion of the aluminum alloy casting would have .718 of the weight, 1.33 times the strength, and 2.66 times the stiffness of those of the corresponding part of the steel casing.

A judicious insertion of "stiffening" webs on such a casing greatly adds to its rigidity.

Comments Upon Factors of Strength

It has been pointed out on many occasions that the use of the term "factor of safety" is misleading, and yet the erroneous use of this term still continues. It would appear to me that a true "factor of safety" should be the ratio between the stress which may be safely applied indefinitely under the actual working conditions to the stress actually employed, and not the ratio of ultimate stress of the material under a static test to stress thought to exist in practice, as calculated from imperfect data combined with many doubtful assumptions. This latter ratio, whilst very useful in formulating empirical rules, should really come under a very different name, such as, for instance, "factor of contingency," already proposed by Mr. Lanchester.

The actual values of this factor, employed in modern design, have been arrived at largely by the method of trial. I would suggest that better results might be obtained, and fewer mysterious failures result, if the various contingencies to be allowed for are carefully examined and the "factor" placed on a more definite basis. A few of these contingenies may be mentioned. In the first place, I might mention low elastic limit as compared with maximum stress. The

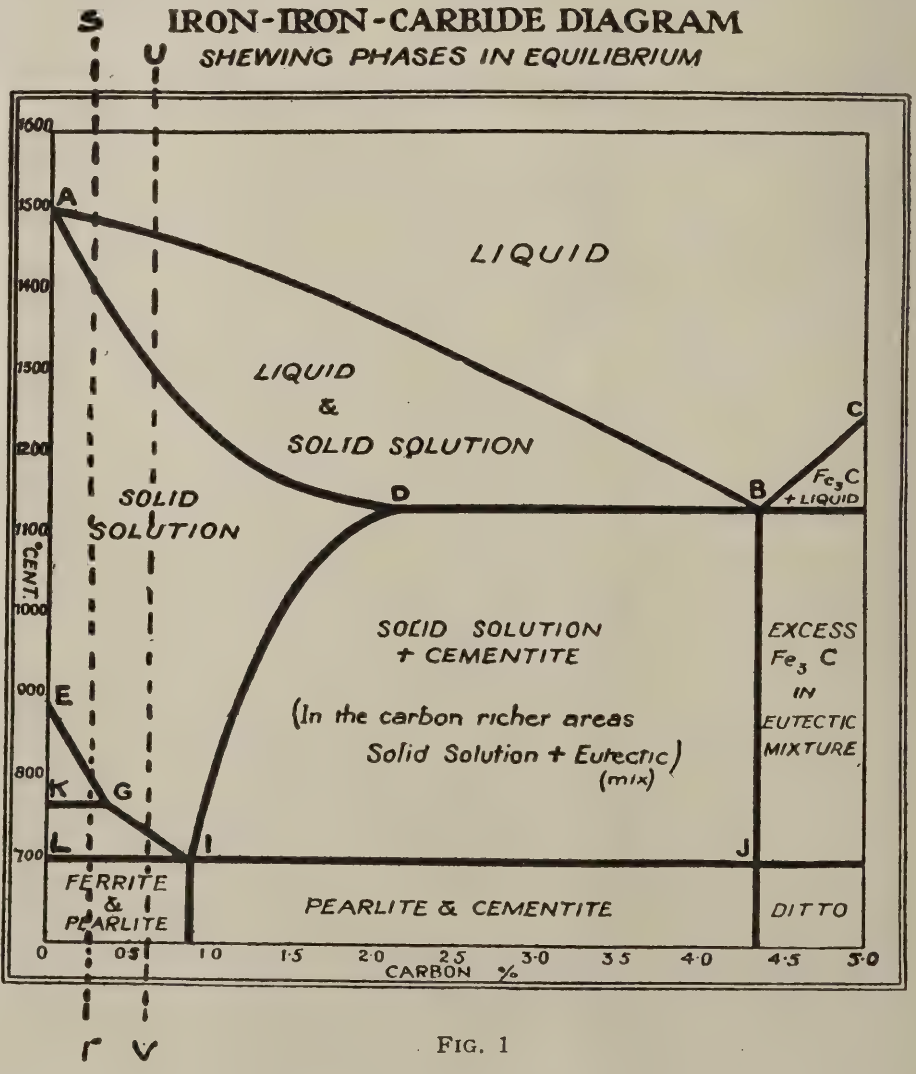


FIG. 1

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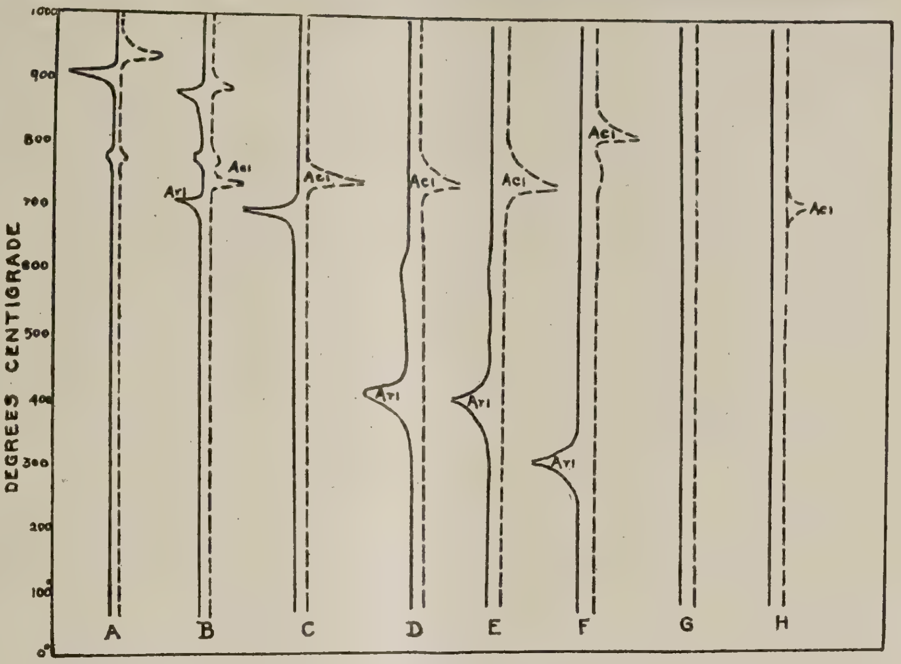
*Paper read before the Aeronautical Society on April 18.

†The factor of strength as fixed by the authorities is well known to be so many times the load borne by the supporting surfaces during straight horizontal flight.



ABSORPTIONS AND EVOLUTIONS OF HEAT WITHIN THE STEELS DURING HEATING AND COOLING.

Fig. 2

— — — — — — — — Heating Curves. ———————— Cooling Curves.
Size of Recalescence Piece = 1" × ½" dia.
A Pure Iron B Casehardening Steel C Carbon Steel D High Tensile Steel
E Airhardening Steel F Stainless Steel G 25% Nickel Steel H Manganese Steel

difficulty of measuring the true elastic limit militates against this fundamentally important figure being determined as frequently as it should be, and whilst mentioning this I would say that our ignorance as regards the properties of steels below the yield-point is, in my opinion, considerable, whilst of the properties between the yield and the breaking stress it is still greater. The Wohler phenomena also merit the most careful consideration. The rapidity of load is also extremely important. Variation of temperature, too, has a recognizedly marked influence upon the physical properties of steel, whether reference is made to high temperatures or to low temperatures, and influence of the ranges of temperature to which the parts have to be submitted in practice should be carefully studied as regards the effect upon the properties of the several steels under consideration and more use made of metallurgical research in this direction. Unequal distribution of stress, particularly near the shoulders, is a well-worn theme. It cannot be too often insisted that sharp corners, or shoulders with fillets of small radius, are bad design. Their evil effects are more marked under repeated stresses than under steady stress. The strength of a member may be reduced 50 per cent or more due to this cause.‡ The reason is that local deformation may occur, which is deadly when alternating stresses have to be incurred. Corrosion might also be carefully and profitably considered, particularly as regards seaplanes, where salt water has to be taken into account. Other items which appear to me to require more attention than they do receive are:

(1) The internal stresses left after forging and probably also after heat treatment.
(2) Non-uniformity of material. This particularly applies to non-uniform conditions produced in the materials by unskilful methods of manufacture and heat treatment.
(3) Non-reliability of material is extremely important, as I shall no doubt illustrate to you, and it should be borne in mind that here the methods of production and the care which should be taken by the steelmaker are the important factors; inclusions of slag, exaggerated sulphide inclusions, defects caused by unsatisfactory treatment in the forge, and last, but not least, hardening cranks.

These items are extremely important, and admittedly, with possibly the exception of the last-mentioned one, outside the control of the engineer, but at the same time they should be taken very seriously into account, more from the standpoint of insisting that the materials and treatments are of such a standard as he has a right to expect for such important work as that under discussion.

Parts in Detail

I now propose to qualitatively discuss one or two of the items, and hope the discussion will amend and extend any observations which are made.

The crankshaft is one of the most important parts, and requires very careful study. No doubt engineers look with pride upon efficient designs, and yet such fail at times. Now, if failure takes place, over-stressing has been a fact, whatever may be the ingenious argument of the designer, and hence—and this is a typical case—not only must one examine the design and material of the crankshaft, but also, as my friend Mr. Dickinson§ has pointed out, the influence of the various other items with which it is in operation. It is desirable that an engine should develop a steady torque, and that it should run as free from vibration as possible. This, we understand, is usually accomplished by a suitable arrangement of the cylinders and cranks, such that (1) the torque developed by one cylinder shall level up the irregularities in point of time in the development of torque by the others; (2) the inertia forces consequent on the high rate of revolution shall be so disposed as to give dynamic balance. Attention must also be given to the fluctuation of torque, and to the effects of inertia forces in the individual parts of the engine. In a multiple-throw crankshaft the variation of torque at the point near the portion just before the last crank may be from the maximum to zero, or to a negative value. If the shaft is of uniform strength, failure is to be expected at such a point rather than at the point where the stress is more uniform. Bending stresses due to overhanging propeller, etc., would, of course, modify this, and bending at intermediate points due to pressure on crank pin must also be considered. It is stated¶ that trouble frequently arises from insufficient stiffness. A certain amount of flexibility of the shaft under torque should be rather an advantage than otherwise, but it is essential that the crank case and bearings should be rigidly fixed so as to prevent undue bending action coming on the crankshaft. Accurate fitting is essential to provide this, and at the same time permit free rotation of the shaft in the bearings.

Special care must be taken with the design of the connecting rod. The maximum stress it has to stand is practically that due to the direct pressure from the explosion. When this takes place the crank is nearly on dead center, and the force is received as compression. Before the engine has got up speed the force in the connecting rod is practically all compression, fluctuating from zero to maximum. At full speed the inertia forces reduce the compression in the connecting rod at explosion and set up tension at other parts of the working cycle. The full range of variation of stress has to be considered, taking into account also the bending stresses due to centrifugal action and the possible modification of stresses due to back-firing. The H section appears to be superior to the hollow tubular section in preventing buckling. Whichever shape is used, special care must be paid to the design of parts where the intermediate length is joined on to the ends which form the bearings. The transition must be very gradual. Any abrupt change will cause concentration of stresses on local areas, which may lead to trouble.

There seems to be an astonishing divergence of opinion as regards the material best suitable for pistons, cast iron, steel, *aluminium alloys* all being in use at the present time. Cast iron appears to be superior in wearing qualities, and is found less liable to seize, though this may in part be due to the greater rigidity obtained by employing greater thicknesses of metal, although at high temperatures cast iron is apt to distort and give out. One of the most important points is that the material of which the piston is made shall not deteriorate under the temperatures developed. I have on at least one occasion had definite indication that the piston-head had spent a considerable time in service about the carbon change-point, *i.e.*, above 730° C. Generally speaking, the fluctuations of temperature during a cycle of operations takes place too rapidly for such changes to materially affect the temperature of piston or cylinder walls, except just at the skin of the material. The possibility of attainment of extremely high local temperatures at the skin depends largely on the "thermal conductivity" and "specific heat" of the material, high values of these constants tending to reduce the fluctuation in temperature.

When we come to consider cylinders here again rigidity of form is an important consideration, as distortion due to temperature may put unexpected strain upon the parts. Incidentally, different materials are unequally affected in their mechanical properties with rising temperatures.

Mechanical Testing

Tensile—The most directly useful and most used mechanical test is the tensile. The quantities usually measured are the yield-point, maximum stress, elongation per cent, and reduction of area per cent.

For many steels the yield-point is *not* a definite value, and the value put down for this item in a particular test depends on the personal factor and ideas of the operator. The method of determining the load which causes a sudden elongation, measurable with dividers, answers very well for a mild steel, but leaves a great deal to chance with the high-tensile materials—particularly when it is remembered that a pull of 65 tons per square inch on a 2-in. test-piece will give 1/100 in. elastic elongation. In how many works tests does the operator have the load run back from about the yield-point position to try if there has been permanent set? If yield-point is to be taken as a guide as to the value of "true elastic limit," and if elastic limit is to be taken as the basis of design, then this quantity must have much more attention than it usually receives.

The "maximum stress," as generally understood, *i.e.*,

$$\frac{\text{maximum load,}}{\text{original sectional area,}}$$

can as a rule be determined exactly. What the maximum stress signifies may not always be the maximum stress of which the material is capable. It has been shown that it is possible with a ductile material,‖ by a simple modification of the shape of the test-piece, to make it withstand a higher stress than the maximum as ordinarily determined. It would be an interesting addition to the data usually obtained from the tensile test if the actual breaking load per square inch of reduced cross-section could be more frequently determined. There would be no difficulty in doing this with machines in which the adjustment of the jockey weight forward and backward on the beam is operated automatically.

The elongation and reduction of area per cent, which are usually taken as measures of "ductility," do not always increase or decrease together, and therefore do not indicate the same property of the material. In a test-piece which has suffered marked local contraction the possibilities of the material are indicated by that portion which has been most severely strained—*i.e.*, near the fracture. Since the density of the material is almost unaltered by strain the ratio of increased length to original length of the material very close to the fracture is practically the same as that of original area to contracted area. Hence percentage reduction of area is a better guide to ductility than elongation, and has the further advantage of being less dependent on the length of the test-piece.

It would be interesting to have that property of the material discussed which is operating if there is considerable elongation taken up uniformly throughout the test length—*i.e.*, without local contraction. The phenomenon may be due to the "stiffening" of the material under strain. Thus, if there should be a slight accidental local extension accompanied by contraction, the increase of strength resulting from the strain probably makes these portions stronger than the rest of the test-piece, in spite of the reduction of area. The straining which follows, therefore, takes place on the less strained parts. It may be that a careful study of the relationship between elongation and reduction might throw some light upon the relative manner in which steels will respond to stresses above their elastic limit. With materials which form a "waist," the stiffening" under strain may still take place, but not sufficiently to compensate for the reduction of area.

(To be continued)

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‡Stanton and Bairstow, Proc. Inst. C.E., 1906, vol. clxvi.

§Institution of Automobile Engineers, November, 1915.

¶Burls, p. 137, "Aero Engines."

‖P. Breuil.

BIPLANE AND MULTIPLANE WING SECTIONS

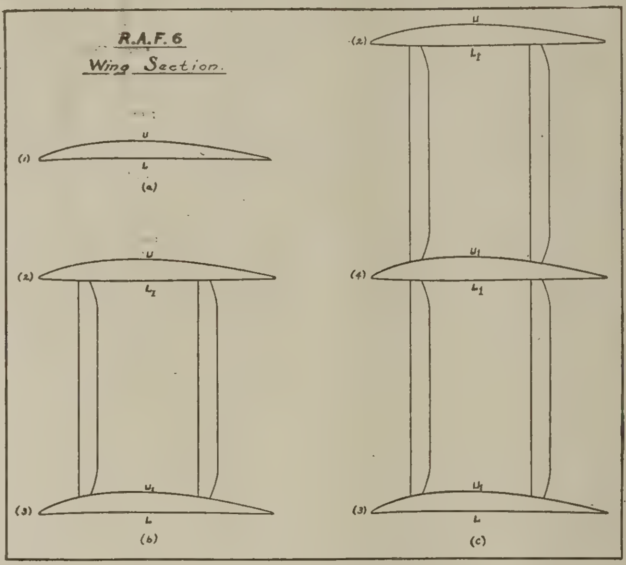
By Flavius E. Loudy

The eliminating processes of the present war are responsible for the disappearance of the monoplane. The biplane now holds the field because of its greater inherent structural advantages provided by its girder-like construction, and the compactness resulting from the smaller spread required for a given area of wings, an advantage in landing in restricted places and in storage and shipment. For the same reasons when we enter the realm of the large machine, the multiplane will supersede the biplane. Yet today we are still using monoplane wing sections in the cellules of our biplanes and triplanes with a consequent lowering of Ky and L/D for corresponding angles of incidence.

It has been demonstrated by Eiffel, N. P. L. and others that a monoplane wing section used in a biplane or triplane shows the same characteristics except for the lowering of its efficiency. However, it is possible by slightly modifying a given wing section to counteract this. It is simply a matter of reducing the interference of the under side of the top wing and the top side of the under wing, thus giving more or less camber to the surfaces facing each other, remembering of course that air arriving on the convex side increases its speed while on the concave side the speed is much reduced.

In the above figure is shown the R. A. F. 6 wing section in biplane and triplane combinations, modified to fulfill the above conditions. The unaltered surfaces are designated as U and L, while those modified are called U_1 and L_1. Looking at Fig 1*a* you will observe that L on the upper wing has been changed to L_1 by making it slightly convex, thus increasing the velocity of the air on that surface, at the same time offering little interference to the upper surface of the lower plane, that one being the most important. Experiments have also proven that altering the lower surface of any wing section only changes its characteristics slightly. I have

(*Continued on page* 540)

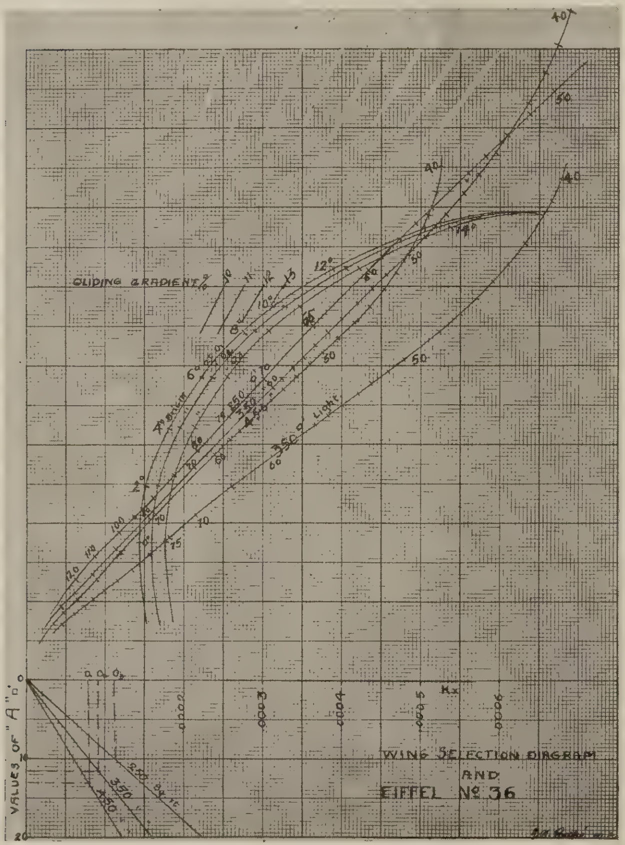


METHOD OF WING SELECTION

By J. A. Roché

(*Continued from page* 325)

The values in the following tabulation can be obtained by means of a slide rule or by the use of the charts which appeared in the previous installment of this article.



V	V^2	V^3	E %	H.P. × E	For 250 Sq. Ft. K_x	K_y
30	900	27,000	35	42	.001962	.0104
40	1,600	64,000	40	48	.000946	.00585
50	2,500	125,000	55	66	.000666	.00374
60	3,600	216,000	62	74.4	.000435	.0026
70	4,900	343,000	68	81.6	.000300	.00191
80	6,400	512,000	73	87.6	.000216	.001462
90	8,100	729,000	77	92.5	.0001602	.001155
100	10,000	1,000,000	78	93.6	.0001182	.000935
110	12,100	1,331,000	77	92.5	.0000876	.000773
120	14,400	1,728,000	73	87.6	.0000640	.000650

	For 350 Sq. Ft.			For 450 Sq. Ft.		
V	K_x	Loaded K_y	Light K_y	V	K_x	K_y
30	.001402	.00742	00565	30	.001088	.00577
40	.000676	.00417	.00318	40	.000525	.00325
50	.000476	.00267	.00203	50	.00037	.00208
60	.000311	.001854	.00141	60	.000241	.001442
70	.000214	.001362	.001037	70	.0001665	.00106
80	.001043	.001043	.000794	80	.00012	.000812
90	.0001144	.000825	.000627	90	.000089	.000641
100	.0000844	.000667	.000508	100	.0000657	.000519
110	.0000625	.000551	.000420	110	.0000486	.000428
120	.0000455	.000463	.000353	120	.0000355	.000361

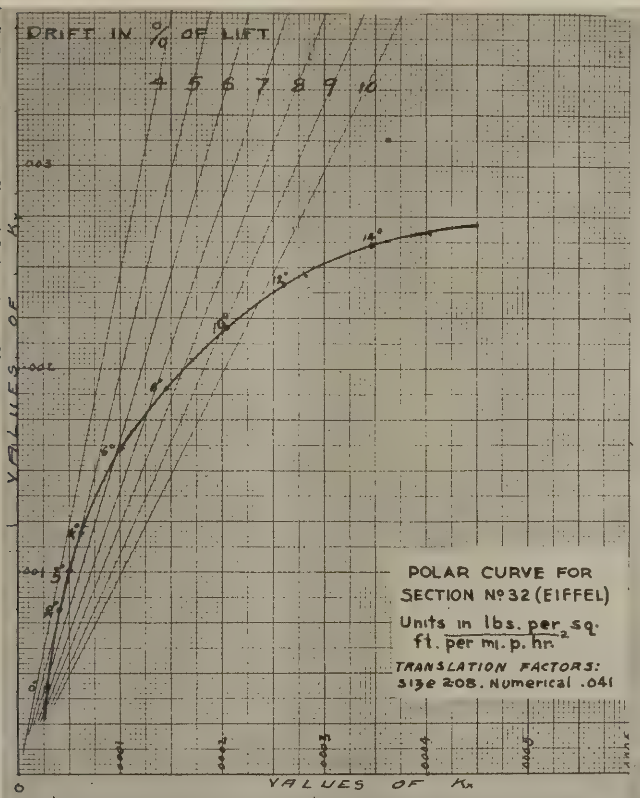
The above tabulation could be further improved by letting the weight change for each value of area, as would be the case in practice. The effect of this would be to bring closer together the ordinates of points on the diagram.

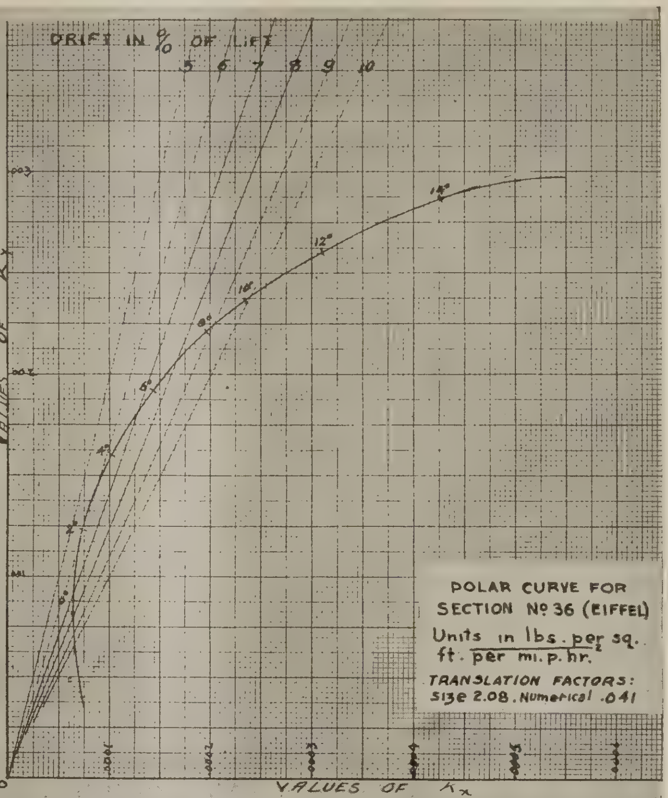
Let us provide ourselves with polar curves of the wing sections that we wish to consider and draw them up to the same scale as the diagram. For ease of inspection, either the polars or the diagram should be on transparent paper so that we may place one over the other and still see both. To supply the example, 4 polars of today's most fashionable curves are herewith presented with the selection diagram superposed.

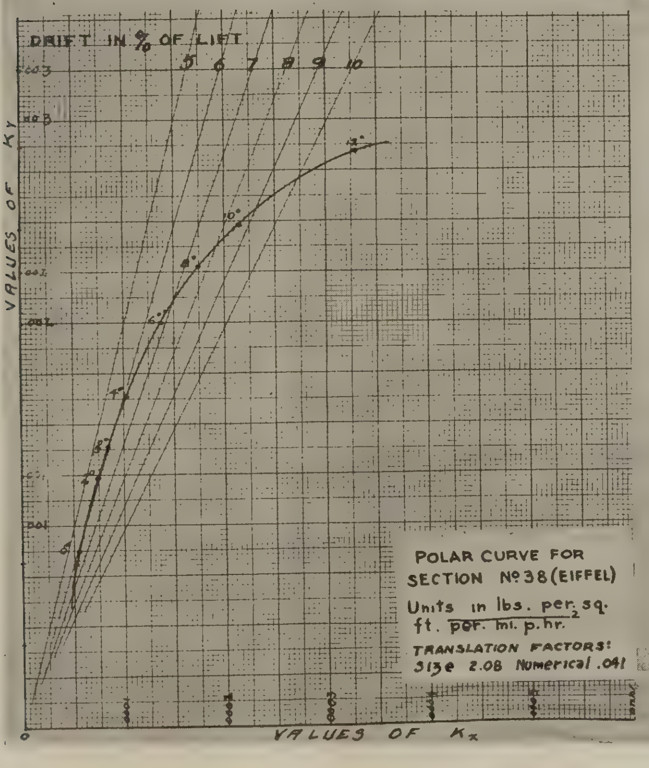
With the above material at hand we can now proceed to select our wing. The observations can be tabulated as follows:

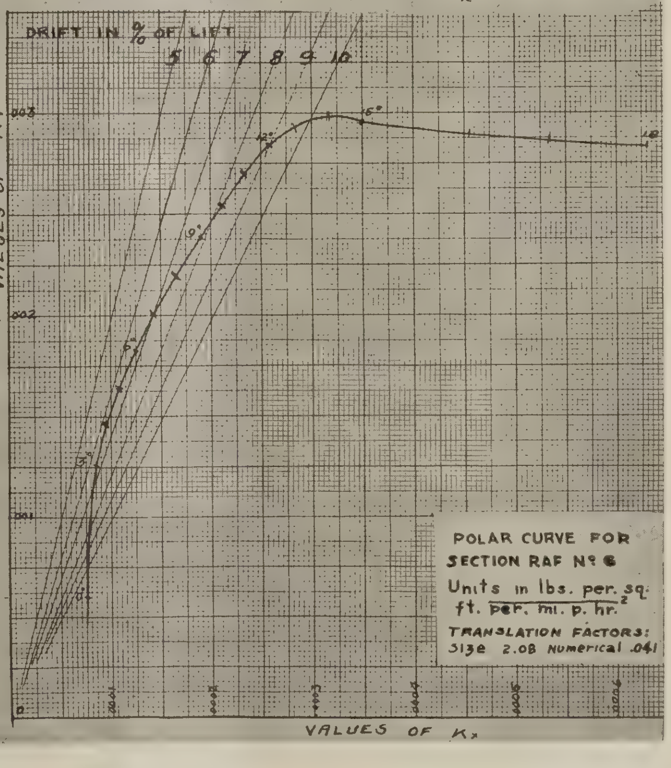
READINGS FROM WING SECTION DIAGRAM

Section	Area	High Spd V	i	Low Sp'd V	i	Best Glide V	i	Gd. %	Excess Power V	i	%
R.A.F. No.6	250	83	3½°	56.6	15½°	60.5	8¼°	12.5	65	8¼°	22.2
	350F	77	2½°	48.3	16°	56.5	7½°	11.75	54	8½°	32
	350*L*	77	1¼°	42.2	17°	49.5	7½°	11.75	47.5	8½°	51
	450	71.5	1½°	42	16°	53	6°	11.1	48	8°	39
Eiffel No. 32	250	86	4—°	61	13½°	77	6°	13.	75	7°	15
	350F	83	3°	50	15°	65	6°	11.75	63	6½°	27.3
	350L	87	1¼°	43	17°	55.5	6°	11.75	55	6¾°	47.4
	450	80	2°	44	15°	59	5½°	11.	55	6½°	35
Eiffel No. 36	250	85	2½°	59	12½°	72	5°	13.1	69	7°	15
	350F	79	1°	48½	14°	73	5°	12.	72	5°	22.3
	350L	80	−½°	41½	16°	54	5°	12.	51	5½°	47.5
	450	74	½°	42.7	14°	56	4.5°	11.25	53	5½°	35.4
Eiffel No. 38	250	85	2½°	57	13°	67	6½°	12.25	67	7°	23
	350F	80	1°	47.5	14°	56	6½°	11.25	56	7°	34
	350L	83	−½°	43	16°	49.5	6½°	11.25	49	7°	52
	450	77	0°	42	14°	52	5⅙°	10.62	50	6¾°	40









The selection can now be made according to the results desired with proper regard for the structural qualities of the sections. We will thus have selected, in a sure way, the best wing for our purpose, and a performance curve can now be drawn. This method enables us to visualize the effect of changes in the various factors, as follows:

1. Since K_y is not dependent on P, equal velocities attainable with various H.P., for a given area and weight, will lie on the same horizontal line, i.e., if our power is changed the abscissae will vary proportionately.

2. Since K_x does not depend on W equal velocities for a given area and power will lie on the same vertical for all values of W, i.e., if our weight is changed the ordinates will vary proportionally.

3. A tangent drawn to a polar from the origin of the diagram will show by its point of contact the value of incidence for the best gliding angle, on the same horizontal we read the corresponding speed, the slope gives the value of the best gliding gradient.

4. The little diagram in the lower part shows how parasite resistance cuts down the speed and excess power and its relative importance on machines of large and small area.

The accuracy of the performance promised by this method depends on the accuracy with which the head resistance, power available and the correction factors have been determined. The accurate selection of each one of these presents a problem by itself.

DESIGN AND PRODUCTION OF AIRCRAFT IN WAR TIME

By Wing Commander, I. W. SELDON*

FROM what I have so far read and heard, I have gathered, perhaps quite wrongly—indeed, I sincerely hope so—that manufacturers here are far more anxious to reproduce standard types of aircraft, than to enter the field as designers and builders of original types of aircraft.

However that may be at the moment, I am perfectly certain that very shortly after a firm has learned to turn out a good standard article, that it will be attacked by the most exhilarating of all microbes, to-wit, the microbe which makes men design aircraft that shall go one better than anyone else's.

For the moment then I want to deal with the design of military aircraft in war time.

We may well start out with one of the proved facts of aerial warfare: "The command of the air rests very largely indeed with that side that produces the best single-seater fighter." Provided, of course, that it is produced and used in sufficient quantity.

This state of affairs is so clearly recognized in France and Great Britain that particular attention is devoted to the improvement of this type, with the result that new and improved designs are now being built and tested as fast as possible. This results, of course, in many new designs being produced, of which, however, only a few show outstanding merit and are consequently reproduced in quantity. Of the designs hitherto popular some have survived a year, some six months, and some have only had a life of usefulness on the Western Front of three months.

The designs that have lasted a year have always finally overstayed their welcome, and I think that probably we shall find a "vogue-period" for the single-seater fighter type to be never more than six months in the future.

The real reason of this is, of course, that it takes the enemy not more than six months in which to get to know all about any particular type and copy or improve it, if he has not already something better of his own. Then something better has to be forthcoming or command of the air will have to be conceded.

The same line of progress certainly applies to other types of aeroplanes than the single-seater fighter, as also to various types of seaplanes, but to a far less extent; it is unnecessary to labor the point.

It is clear then that the designer, particularly the designer of the small fighting aeroplane, whether he be in France, Great Britain or America, is always confronted with the problem of designing a type that is an advance on any contemporary machine of a similar type. A machine can be an advance on a similar type in one of two main respects:

(a) Because it possesses a better performance.
(b) Because its fighting facilities are better.

Each of these main headings includes a number of subdivisions; thus better performance may mean better climbing only or better speed only or greater endurance or any combination of these, while better fighting facilities may mean better maneuvering capacity or better view or better positions for guns or improved weapons or any combination of these.

The designer then who sets out to design a new type must proceed along one or more of the following general lines:

(a) Increase the horsepower-weight ratio.
(b) Decrease the wing or structure resistances.
(c) Devise a new arrangement of the supporting planes, with regard to the position of pilot or crew.

Improvement in the horsepower-weight ratio is most readily achieved by the utilization of greater horsepower or engines lighter per horsepower than those employed in the type he is designing. It is said most readily achieved, and this is because progress in aviation engines is still fairly rapid. But a good deal can be done by close and accurate design, which implies the removal of all redundant weight.

Improvement in wing resistance is a matter for the wind-tunnel experimentalist and not for the designer, but the converse has actually been true in a great measure in the past.

Improvement in structure resistance requires the designer and the wind-tunnel experimentalist to work closely together, but it involves in any case the reduction of exposure of engine parts, external fittings and controls, besides the accurate shaping of the body and the simplification of the chassis, which are matters entirely for the designer.

Variation in arrangement of supporting surfaces. It is possible to vary the arrangement of the planes in an infinite number of ways, but the prime object in view is practically always to improve the view of the pilot, and roughly therefore the favored types are the parasol monoplane, the biplane with planes of unequal chord and the heavily staggered triplane. It is probably true that the practically unstaggered equal-planed biplane with a gap equal to the chord and an aspect ratio, in accordance with the gross weight, running from about five in very small machines to perhaps ten in the very large ones, gives about the most efficient aeronautical arrangement for an aeroplane.

Any deviation from such an arrangement may and usually does involve greater efficiency of the supporting surfaces, but at a cost of greater weight. It is possible to make these two factors balance and perhaps even show an over-all aeronautical advantage for the unusual arrangement, but a designer has to be most intimately acquainted with every branch of aeronautics before he can attempt such arrangements with any real chance of making good against the simpler structure.

I now want to return to the subject of the reduction of wing and structure resistances, because it is in these two respects quite as much as in the matter of engine design that notable progress has recently been made by designers in France and Great Britain.

There are two ways (of these the first is by far the most important) in which wing resistance has been reduced, namely:

(a) By the employment of low resistance aerofoils.
(b) By properly shaping the wing tips.

To grasp thoroughly the aerofoil resistance problem it is necessary to preface that wind-tunnel research (following indeed in the wake of practical experiment) has now given us a very good range of aerofoils varying from the low resistance aerofoil, which carries about 5 lb. per sq. ft. at 45 m.p.h. at its maximum lift angle, through the medium-lift aerofoil carrying round about 6 lb. per sq. ft. under the same conditions, to the high lift aerofoil which carries 7½ lb. per sq. ft. under the same conditions.

It is obvious that when the minimum speed is specified, if the aerofoil carrying 7½ lb. per sq. ft. is utilized in place of that carrying only 5 lb. per sq. ft. (both at 45 m.p.h., the speed usually named) that there will be a very large saving in area and consequently in weight by using the high-lift variety. Moreover it must be borne in mind that the weight saved is not by any means confined to the saving of supporting surface, because firstly the stresses are reduced, then the tail area or length of body may be reduced. In fact, as a rough approximation it may be assumed that the saving is at the rate of 1½ lb. per sq. ft. of area saved. This at once very materially increases the horsepower-weight ratio in favor of the high-lift winged machine.

Moreover, with the reduction in area and weight there comes improved view and ease of handling—except that in dives the high-lift wing type will have a comparatively low limiting speed.

Notwithstanding these factors, however, the resistance of the high-lift type of aerofoil is so much greater than that of the low resistance type at fine angles that as soon as the horsepower for weight is increased beyond perhaps 1 hp. to 17 or 18 lb. we find that the speed range of the low resistance type increases far beyond that of the high-lift type.

To illustrate this point, it is quite possible that the super-scout of the near future with a low resistance type aerofoil will have a speed range of 50 to 150 m.p.h. The same machine fitted with a medium lift type curve such as R. A. F. 6 would probably achieve 50 to 125 m.p.h. and with the highest lift aerofoil 50 to 100 m.p.h. only.

The horsepower curves for various aerofoils ranging from the lowest resistance type so far experimented with, through the medium lift to the medium-high lift type are given in Fig. 1 and illustrate clearly the point that while excess horsepower is of value in the low resistance aerofoil it becomes increasingly wasteful as the lift of the aerofoil is increased.

Fig. 1—Horsepower Curves for Various Types of Aerofoils

It also illustrates how little difference there is in the climbing rates of any aerofoil despite the weight handicap carried by the low lift type.

To conclude, I urge that inasmuch as two heads are better than one, so three are better than two; consequently it is most desirable that the designers in this country be encouraged to compete in the race of producing the best fighting scout.

The field is perfectly open and the judging is above suspicion because the ultimate judgment is recognized to be in the hands of the pilots, who demand to be supplied with the best and only the best.

---

* Royal Naval (English) Air Service.

Paper presented at the Washington meeting of the S. A. E.

(*Continued from page* 525)

tor construction. Offsetting the crank has two effects, one to cut down the guide pressure of the piston and cylinder, and the other (which is purely a secondary effect) to lengthen the stroke of the piston, as the offset is increased with any given crankpin circle.

Sizes of Engines Required

It begins to be more and more apparent that engines of less than 200 hp. have only a limited field.

Even in the small, high-speed scouting machines which fly from 125 to 140 m.p.h., it has been found necessary to use upwards of 300 hp. This does not mean that they actually have 300 hp. at the altitude at which they usually fly, but only a fraction of this, and the major problem which is at the present time confronting aviation motor designers is to compensate for the loss of charge weight at the higher altitudes. The enormous drop in temperature experienced when rising to heights of from 16,000 to 20,000 ft. also brings in serious carbureter difficulties, and it is almost impossible to simulate on a test block the conditions imposed on an aviation motor when in the air. As everyone knows the difficulties of operating a motor car in the winter, it will be readily appreciated that when a motor in the course of 10 min. operation has to pass through the whole range of temperatures experienced from summer to winter, difficulties of no mean order will be encountered.

What we need immediately in America is a large number of training planes, but we also will have to have battle planes driven by motors that are not equal to but superior to those possessed by the enemy. The real danger, in my estimation, is that the evolution of our engineering will not be fast enough. We have not as yet enough clever minds engaged in these channels and we have not had stimulus for this sort of work. We have always had continually in the past that specter, cost, staring us in the face. A lieutenant in the British Flying Corps said one day last week that there was no question of price at all if a motor would deliver the goods. A very great deal has been done towards securing high horsepower weight efficiency by means of lightening the various parts of the motor structure, and I feel very certain that in a great many particulars this line of thought has reached its limit.

Amount of Mixture Important

The really important thing about aeronautic motors from now on is going to be the number of cubic feet of mixture per minute that a motor can handle, and in connection with four-stroke cycle motors this points out the necessity of using relatively high speeds. The mean effective pressures arrived at in the Sunbeam motors are within 15 per cent of the theoretical maximums that are possible, and while there may be some improvement secured in the future in the matter of horsepower weight efficiency by means of further refinement in the mechanical construction, I believe that it is now necessary to ring in some changes upon the cycle of operation. This should be a splendid opportunity to try out super-compression and super-charging schemes of one sort or another, and possibly for those who have energy to try it, the two stroke engine, with its maze of new problems, stands as an opportunity.

INSURANCE AGAINST ACCIDENT

ABOUT 90% of the accidents on the training field are attributable to mistakes in landing—usually resulting in the collapsing of wheels and their supports.

Exhaustive tests in actual service have demonstrated that Ackerman Aeroplane Wheels eliminate this source of trouble, and as soon as the inherent prejudice concerning "something new" has been eliminated, every machine that is produced in this country will be equipped with Ackerman Wheels.

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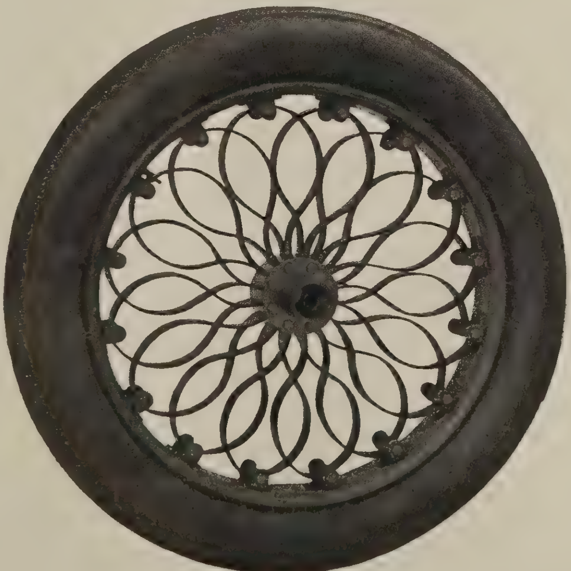

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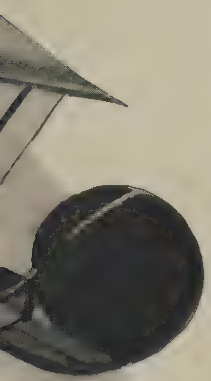

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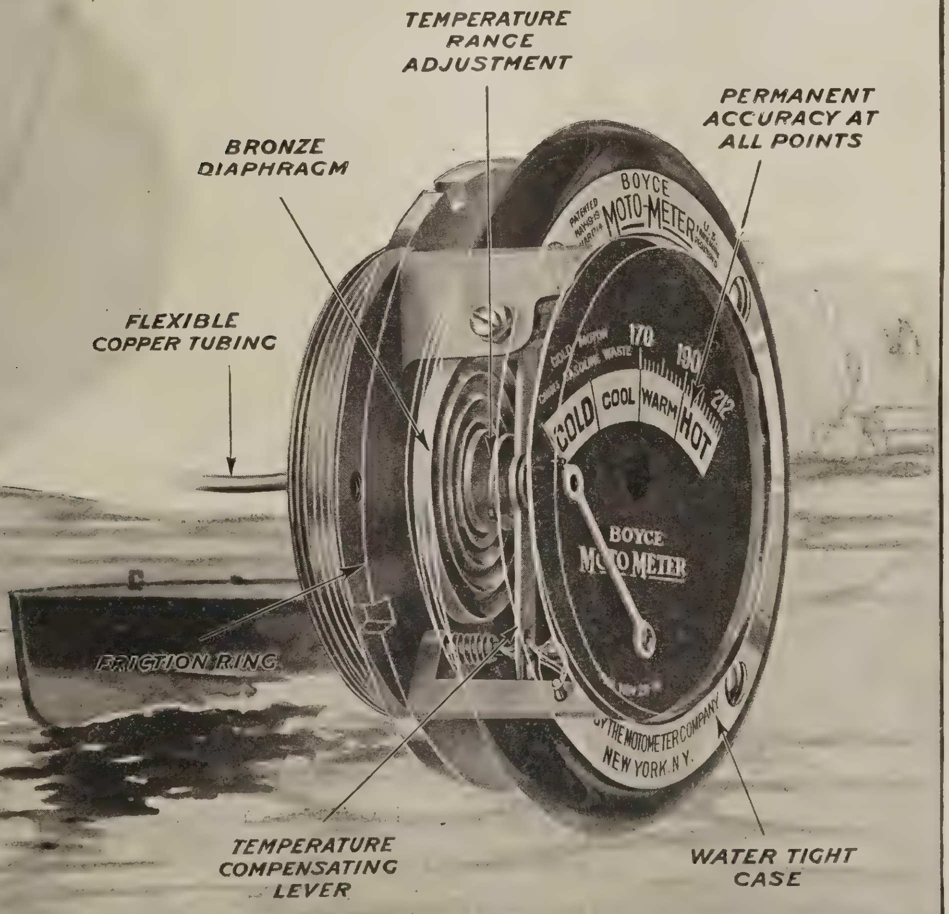
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FOREIGN NEWS

FRANCE

Mediaeval archery with bows and arrows is one of the favorite sports of the American aviators of the Lafayette squadron during the hours when they are not flying over the German lines in search of German "birds." On their flying ground they have erected a target and many of them have become experts with the ancient weapon. They vary the sport with periods of target exercise with their machine guns, which they are called upon to use very frequently on their aerial expeditions.

Often when they are flying at great heights and terrific speed they are pounced upon by German airmen who have managed to hide themselves behind banks of clouds, perhaps a thousand feet above them, or they themselves have obtained the position of advantage and then they come down with a sudden swoop and pepper the enemy machine with bullets. They have been generally extremely successful in their expeditions, as is proved by the big bag of thirty-two German victims to their flying and shooting skill. Others also they have sent crashing to earth, but so far behind the German lines that the fall could not be confirmed by observers in the French lines, and, therefore, they have not received credit for their achievements.

The French officers in charge of the squadron are sincerely proud of their American fighters, and it is remarkable to see how intimate are the terms on which the officers and men live when in camp. The fact that they are constantly facing death together accounts for much of that, but they also have learned to respect one another for their various qualities. There is no need to impose strict military rules, for, as the officer in command explained, discipline is absolutely spontaneous. All ranks join together at mess and in their cantonment there is equal division of accommodation.

When an expedition is to be undertaken everybody is eager to be included. The men are asked if their machines are all right and a specified number are told off to start at a certain hour. Others of them, however, always join in the flight, for all are ever eager for adventure.

The return of the expedition, usually set for a certain hour, finds the American airmen following one another rapidly to the aviation ground and landing within a few yards of the Stars and Stripes, which has flown there ever since the United States decided to come into the war. There is no excitement. Each man gives his verbal report of what he has observed on his flight, and notes are taken by the officer in charge. Then the airmen peel off their overalls and almost at once some game is on foot. It may be quoits played with horseshoes, or perhaps football or archery. Some of them, however, pass much of their time in reading American magazines and newspapers when obtainable, which is not always possible. Others turn their attention to the squadron's mascots, of which there are several, including two lion cubs and a great sheep-dog.

Paris, June 21.—A review of aerial activities is issued by the French War Office for the period of June 8 to 20. Twenty-two enemy aircraft altogether were accounted for. The statement reads:

"Fourteen aeroplanes and a German captive balloon were destroyed on our front in the period from June 8 to 20. Eleven of these machines were brought down by our pilots during aerial combats and three of them by the fire of our machine or anti-aircraft guns. In addition seven enemy machines, seriously damaged, fell in our lines.

"In the same period our squadrons effected numerous stories. They bombarded notably the railroad station at Bensdorf, factories of Hayatge-Jesuf at Moyeuvre, blast furnaces at Betheniville, Chatelet-sur-Retourne, Rethel, Meziers, Charleville and Mobsheim; the Bivouacs in Suippe Valley and munitions depots in the region of Loan, etc. Thirteen thousand kilograms of projectiles were dropped during the expedition, which caused serious damage to enemy establishments."

Paul Rockwell, in his correspondence to the N. Y. *Globe,* says that in France they are in favor of training American aviators as near the battle-front as possible. He says:

"That the quickest and best way for the United States War Department to form a competently adequate aviation corps is to take over one of the already existing aviation training camps in France and instruct American aviators here, is the opinion of leading military aviation authorities with whom I talked when visiting the training school where seventy-five young Americans are learning war time flying. American student pilots could take with benefit an elementary course of instruction at home, but I firmly believe that they will make better pilots if they complete their training in the war atmosphere of France and are instructed by men knowing by actual experience what fighting in the air is like.

"An ideal camp for the United States to take over is that which to-day is the largest and most completely equipped training school for aviators in existence. We could find in America or France many fields suitable for aviation purposes, but to take a new field and put it in proper shape for service would require more than a year of hard, skilled labor. Hangars for aeroplanes, barracks for the men, workshops for making and repairing broken parts of machines and different fields for various stages of instruction would have to be got ready. Efficient haste in utilizing our resources for making war will itself count as one victory for us.

"Our party left Paris early in the morning in automobiles and arriving early in the afternoon we were shown over the entire school. We visited the workrooms, where men labor industriously beside devoted French women making and testing motors, wings, etc. The workshops are so well equipped that any broken part can be quickly replaced without the long delay of ordering it from the factory.

"One entire building is given over to experts, who determine the efficiency of different explosives, cartridges, and bombs. These buildings, with the barracks for the men, and the administrative building, form the central part of the camp. At varying distances and in all directions around the central camps are grouped fields for elementary and advanced training.

"There is one field where the newest men learn the rudiments of the flying game on roller machines, which are like aeroplanes, except that the wings are too small for them to leave the ground. For other classes there are separate fields, including one where pilots brevetted from other schools learn the difficult part of flying fight machines.

"The personnel of the school includes student pilots. The majority of the French students are lads who have served in the trenches and been wounded. The very cream of France's fighting youth have been chosen as aviators, and Americans consider it an inspiring privilege to train with them.

"A captain told me that on a fair day more than 2,000 flights are made at the school. Theses flights total more than 40,000 kilometers (24,000 miles), or approximately the distance around the earth. Of gasoline 15,000 litres (15,000 quarts), are consumed daily. The breakage expense is enormous.

"Students not only learn to fly, but to fight in the air. Ingenious contrivances are used in teaching them to shoot at and hit airplanes flying at various distances, or drop bombs accurately upon a determined objective. It takes a man with average aptitude for the service three months and a half from the day he begins training to be prepared to go to the front and fight.

"Accidents in training have been reduced to a minimum. Most of the grave ones result from over-confidence and carelessness on the part of the pilot. Most of the machines used for training are those which have already been in service at the front, but have become a little tired or out of date. So rapidly are improvements made that a fighting airplane which to-day is modern three months hence will be hopelessly ancient.

"This school was one of the first in France. Since the beginning of war, following the development of the aviation service, the school has been enlarged frequently, and it is four times as large to-day as it was three months ago. All pilots brevetted from other schools pass through this one for perfecting them for the types of airplanes used for fighting, artillery fire, regulating, observation, bombardment, and other war purposes. Many of the most famous French aviators have been trained here."

GERMANY

German aeroplanes on June 18 effected a landing on an island in the Bay of Riga and destroyed a Russian base there, it is announced officially. The statement follows:

"Greater activity by Russian naval forces in submarine and mine warfare made necessary defensive measures on the German side, which had the following results: On June 13 our aeroplanes dropped explosive and incendiary bombs in large quantities on Russian bases, obtaining good results.

"On June 14 the military station on the island of Runeo, in the Bay of Riga, was bombed with visible success. Following this enterprise, our aeroplanes on June 15 landed on the island and destroyed the remaining portions of this base. All our aeroplanes returned."

London, June 21.—Cabling from Copenhagen the *Morning Post* correspondent says the Germans, recognizing the failure of Zeppelins in war are now planning a more peaceful use for their airships. "A Berlin telegram," he says, "states that aerial traffic will be developed to a great extent after the war, and a bill to this effect is shortly to be introduced embodying plans formed by the International Air Traffic Society.

"According to this programme the main airship routes will be Hamburg, Berlin, Vienna and Strassburg, and Karlsruhe, Dresden, Prague and Vienna. From Vienna the line will be continued to Budapest and Constantinople. Branch lines will be established in all directions in Germany and Austria."

Amsterdam, June 21.—According to the *Deutsche Tages Zeitung,* the Breslau Socialist newspaper *Volkswacht* has been suppressed for protesting against air raids on London in which women and children are killed. The *Volkswacht* is quoted as saying:

"Truly our British comrades have no easy task in going to Stockholm to negotiate with their enemies. It is a miracle that they are not lynched or torn to pieces in such a moment of fury."

GREAT BRITAIN

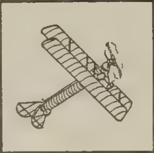
London, June 22.—Public agitation for the adoption of air reprisals against German cities as a reply to recent Zeppelin and aeroplane raids on Great Britain has been the subject of several private conferences between military and political leaders here. The hope was expressed at these meetings that public clamor would not override the saner strategic considerations, and that any elaborate system of reprisals would be postponed until the assistance of American airmen is available.

"The German air raids," said an official to the Associated Press today, "were comparatively easy to perform because they were largely over territory in German possession or across the sea, where the enemy airmen could travel unseen and unopposed. On the other hand, British airmen in executing a reprisal must carry a load of bombs over a route that from the start crosses hostile territory.

"Throughout the flight our airmen must run the gantlet of land guns and air fighters. The most expert airmen would be necessary for such ventures. The percentage of losses would be large and the strain terrific on the flyers, and the element of surprise largely would be lacking against the enemy.

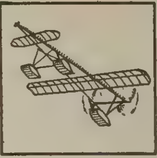
"When we are forced into a reprisal programme it will not be with the object of killing German women and children—that method is viewed with the greatest horror by every Englishman.

"No military success has been accomplished by the few enemy air raids. We do not care for that type of war nor do you in America. If we undertake a programme of raids it will be for the purpose of making German cities so dangerous by repeated attacks that the German must keep his aeroplanes at home for defense."



MODEL NEWS

Edited by G. A. Cavanagh



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Illinois Model Aero Club Bulletin

By Ward Pease

The Illinois Model Aero Club wishes to announce three new world's records. Philip Breckenridge persuaded a tractor model to rise from the ground ond fly for 227.4 seconds, covering a distance of 2,685 feet. He also established the hand launched distance record of 2,354 feet. These records were made at the Ashburn Aviation Field, Sunday, June 10. The model used was a single propeller tractor weighing 1 1-16 ounces. It had a wing spread of 32 inches, an over all length of 28 inches, and swung a 12-inch propeller. Breckenridge is one of the younger members of the club who is working under the supervision of Lindsay Hittle, our most scientific model builder, and to Hittle is due a large part of the credit for these records.

Friday and Saturday, June 15 and 16, the Illinois Model Aero Club held its second annual exhibition of models, parts, drawings, and photographs. The exhibition was opened by the Aero Club of Illinois weekly luncheon at which Miss Katherine Stinson, who has just returned from her tour of Japan and China, was the guest of honor. The exhibition was a complete success, being visited by a large number of interested people.

William P. Dean Still Active

Mr. William P. Dean, the friend of many model flyers throughout this country and England, writes that he is as enthusiastic as ever and if there are any model flyers in Toledo or vicinity he wants to get in touch with them. Mr. Dean as usual is willing to demonstrate how models are made and flown and in view of his wide experience in this branch of the art we feel that young men in the vicinity of Toledo, Ohio, who are interested in models, should avail themselves of the exceptional opportunity which Mr. Dean offers. Mr. Dean can be addressed as follows: Cor. Fairfax and Upton Avenues, R. F. D. 8, West Toledo, Ohio. Telephone, Bell Phone. Collingwood 2787.

Compressed Air Driven Model

Little by little we are drawn to the conclusion that the rubber strand driven model will soon be replaced by the mechanical driven model and as further evidence of our belief we present the description and photograph of a compressed air driven model monoplane designed and constructed by Mr. H. J. Seaman, Chief Engineer of the Union City Electric Light Company, Union City, Pennsylvania. As may be seen by the photograph, Mr. Seaman's model represents careful designing as well as workmanship.

The model has a wing spread of 48 inches with the length overall measuring some 42 inches. The three cylinder Nomie engine drives a 16-inch propeller and on several occasions the model flew under its own power. To demonstrate the stability and good flying qualities of the model Mr. Seaman flew it in a 15 to 18 mile wind.

All planes on the model are double surface and all metal parts are of aluminum. The small semi-circular planes and elevator are operated by an automatic control devise in the cockpit.

For a number of years Mr. Seaman has been interested in the art of aviation.

The Best Length for a Fuselage

By Rev. Alfred J. Bartlett

In some notes written on September 10th, 1913, I drew attention to the advantages of a short *fuselage,* having experimented exhaustively in this direction, and I pointed out that the chief advantage is *quickness of recovery in the event of a dive,* on the analogy of a short-keeled boat, which all yachtsmen will understand.

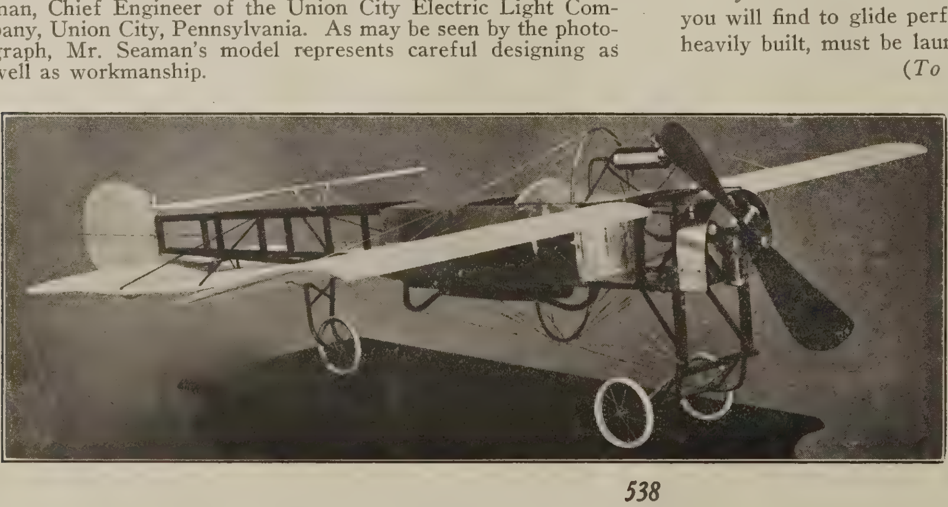
May I now add the following observations?:—

In nature the best gliders have the tail-plane small and close to the body, *e.g.,* the seagull, and this is contracted to the smallest dimensions, *except when required,* while the tail-less butterfly, though not perhaps a true monoplane, glides to perfection, *e.g.,* the fritillary.

This introduces a further interesting problem, viz., not the position but the *function* of the tail-plane. Hypothetically the best glider will be one which requires no tail-plane, except in emergency, because the drag exerted in correcting continuously the faulty tendency of the wing planes reduces speed, besides interfering with the action of the wing tips or *ailerons.*

Hence arises the question of the desirability of a *true* "monoplane," *i.e.,* a glider in which the wing planes possess independent fore and aft stability. The problem itself was experimentally solved by me in years gone by, in proof of which I send you a battered tail-less paper model of a seagull, which you will find to glide perfectly; also a butterfly, which, being heavily built, must be launched with some force.

(*To be continued*)



Compressed air driven model designed and constructed by H. J. Seaman.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

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PRESIDENT of the United

* * *

STATES, or even the

* * *

KAISER OF GERMANY.

* * *

IF THEY EXPECT anyone

* * *

TO GET BY that test

* * *

WHERE THEY whirl you

* * *

UNTIL YOU DO not know

* * *

WHETHER you are coming

* * *

OR GOING, they had better

* * *

GET SOME WHIRLING

* * *

DERVISHES from a circus.

* * *

THEY SHOULD make

* * *

WONDERFUL Aviators.

* * *

MUCH Obliged.

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RUBBER COMPANY
NEW YORK

Striking Through the Air

(Editorial in Indianapolis News)

THOSE Americans who recall that the first aeroplane to be used in a military campaign was used on the Mexican border by American troops in 1911 are amazed to learn that the allied powers are turning out about 4,000 aeroplanes a month and that in many quarters this is considered the most important branch of the army. But such is the case, and such has been this country's part in developing the aeroplane in its early stages, that the allied powers expect great things of us. Whether we shall measure up to the expectations is a serious question, for today the United States has practically no air fleet.

According to a statement issued by the Aero Club of America, entente and American military authorities who have studied the subject are agreed that the addition of 10,000 aviators today to the allies' present aerial forces would insure blinding German batteries and preventing German aviators from conducting operations over or near the allies' lines. In the air battles preceding the last advance on the west front, the British and French aviators clearly demonstrated their superiority. But they did so at great cost, for their losses in men were large. And it is estimated that, owing to hard service, the life of an aeroplane is only six weeks. Hence the need for men and machines

Owing to the necessity of training officers for the land forces and for registering and choosing men to fill out the American land contingent, little public attention has been paid to the air service. But the government is working hard to meet the need of the allies for more aviators. It has summoned the best engineers in the United States to help in designing and building machines, and has sent out calls for men between 21 and 30 to enter the aviation training camps. But it is by no means prepared, and whether it will be by this time next year depends to some degree on the willingness of young Americans to serve in this, the most exciting and useful branch of the service.

(Continued from page 530)

changed U to U_1 on the lower wing by increasing its camber, thus improving the lift considerably without interfering with the under surface of the upper wing. You will also notice that U on the upper and L on the lower wing remain unchanged since they are unaffected in either biplane or multiplane combinations.

The application of this modification theory to the triplane is very simple. A triplane may be considered as two adjoining biplanes. It is only necessary in this case to use for the central wing a section composed of an upper surface of U_1 and lower surface of L_1 contour, the top and bottom planes remaining the same as in the biplane. For any multiplane, then, it is only necessary to insert between the upper and lower planes the proper quantity of No. 4 wing sections that the system calls for.

The "series" is now complete. We have derived three new wing sections from the original R. A. F. 6. For the benefit of the designer, wind tunnel tests should be made of a "series" for several wing sections such as R. A. F. 6, which is a good all around section, universally used at present; Eiffel 32, another good all around section with a very stationary C. P.; Eiffel 37, known as the Kauffman section, for high speed; and R. A. F. 3 for heavy machines such as seaplanes and flying boats. The initial test should be made with a biplane and triplane combination with a gap-chord ratio of 1, an aspect ratio of 6, ends raked 20°, uniform chord throughout, the same span for all surfaces, and without stagger, decalage, dihedral or retreat. The factors just enumerated could be experimented upon later as they are of secondary importance.

We could improve the efficiency still further by proper modification of that portion of the wing affected by the slip-stream of the propeller, the portion above the fuselage and the region of the motors if placed elsewhere than in the fuselage. This again is only a suggestion for future refinement.

The great need today is not for new monoplane wing sections but for modification of the most useful wing sections now in vogue, so that they may be efficiently employed in biplane and multiplane combinations.

"At the Mexican Border, I found an aviator worth a Cavalry Division."
—General Pershing.

"An aviator is worth an Army Corps."—General Kitchener.

In September, the Government will select young men for different branches of the Service. Those who have had aeronautical training will be assigned to the Aviation Section, which is the preferred arm of the Service.

To any man physically fit, between the ages of 19 and 30, the Gallaudet Aviation School offers a splendid opportunity.

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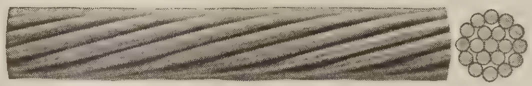

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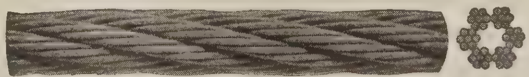

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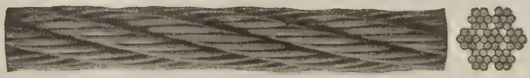

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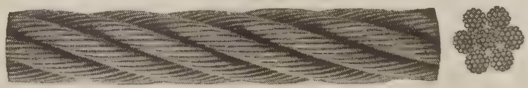

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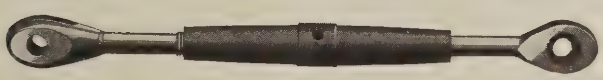

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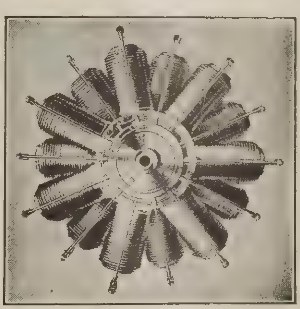

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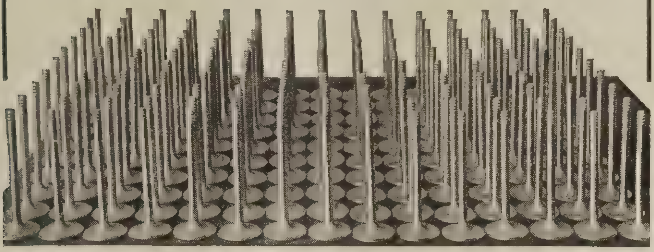

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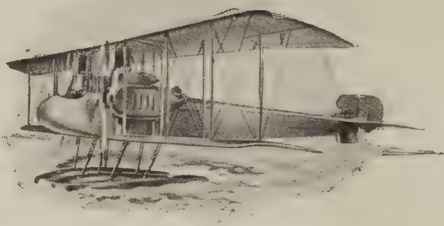

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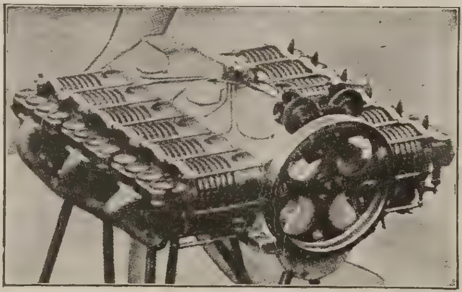

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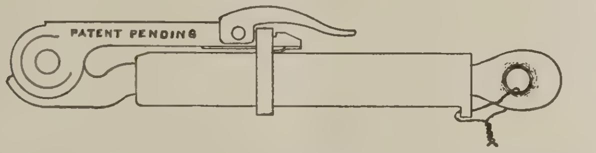

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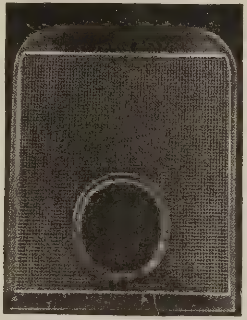

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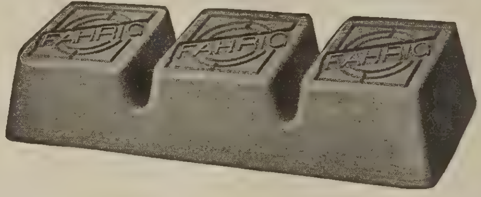

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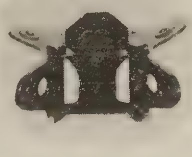

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***Flying* for June**

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Admiral La Caze, the French Minister of Marine, reported to the Chamber of Deputies recently that France has 552 coast patrol units, with seaplane stations all along the coast, so that the zone of action of each joins that of its neighbor. Admiral La Caze's statement, illustrated by the types of seaplanes used in this work, appears in Flying for June.

Amongst other important subjects dealt with in this issue are: Plans and Personnel of the Aircraft Production Board; Balloon Training; Hunting Submarines from the Air; Rules and Regulations Governing Aerial Reserve Corps; and News of the Aerial Coast Patrol Units.

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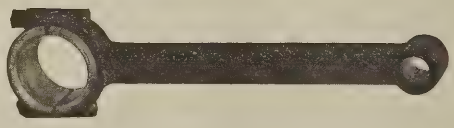

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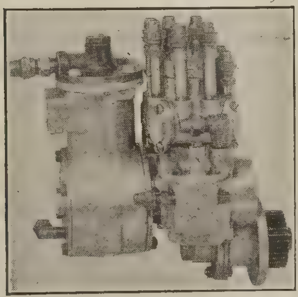

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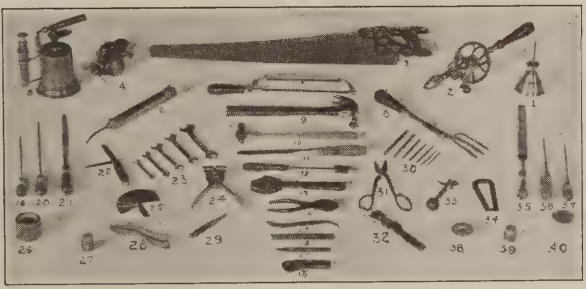

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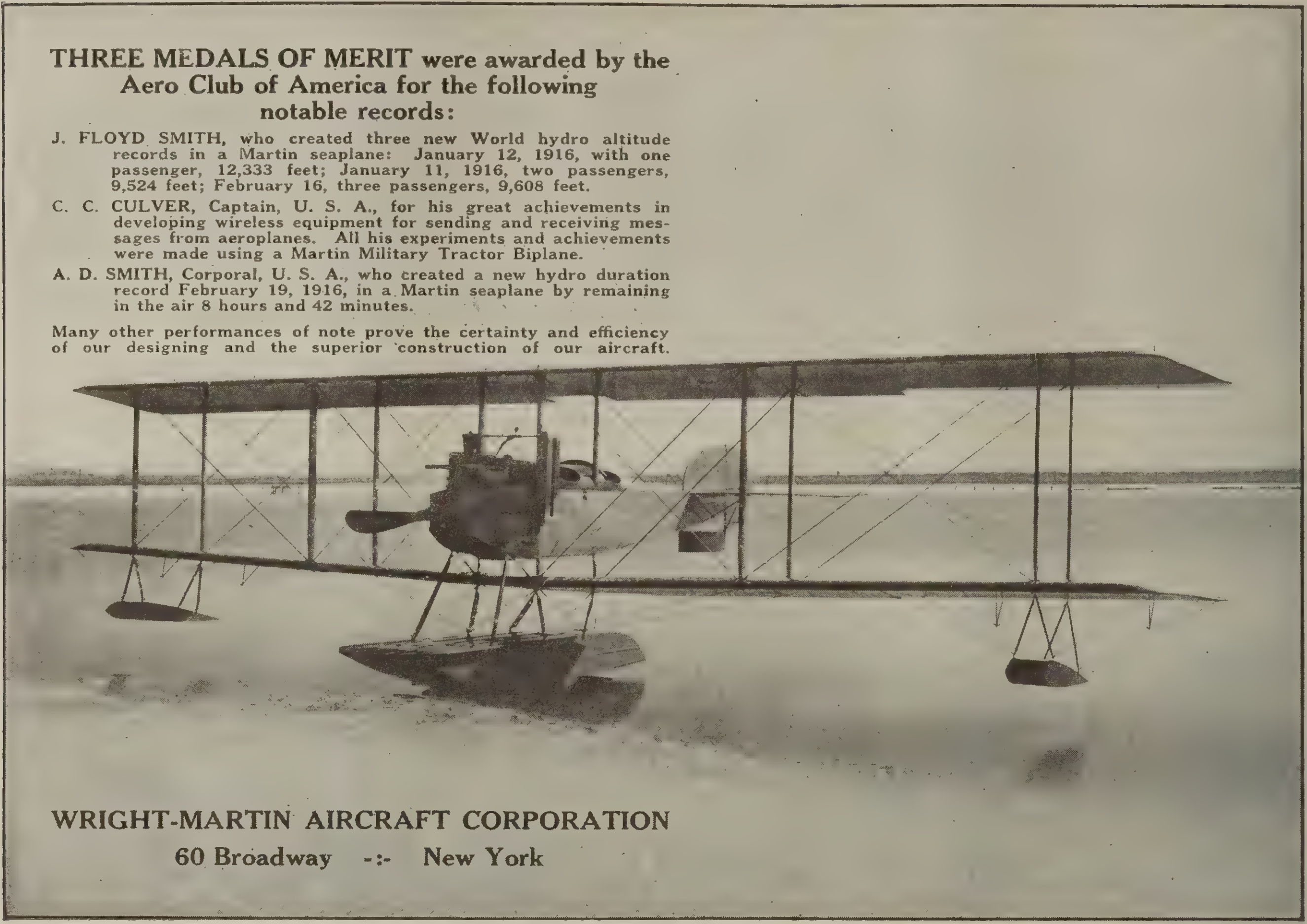

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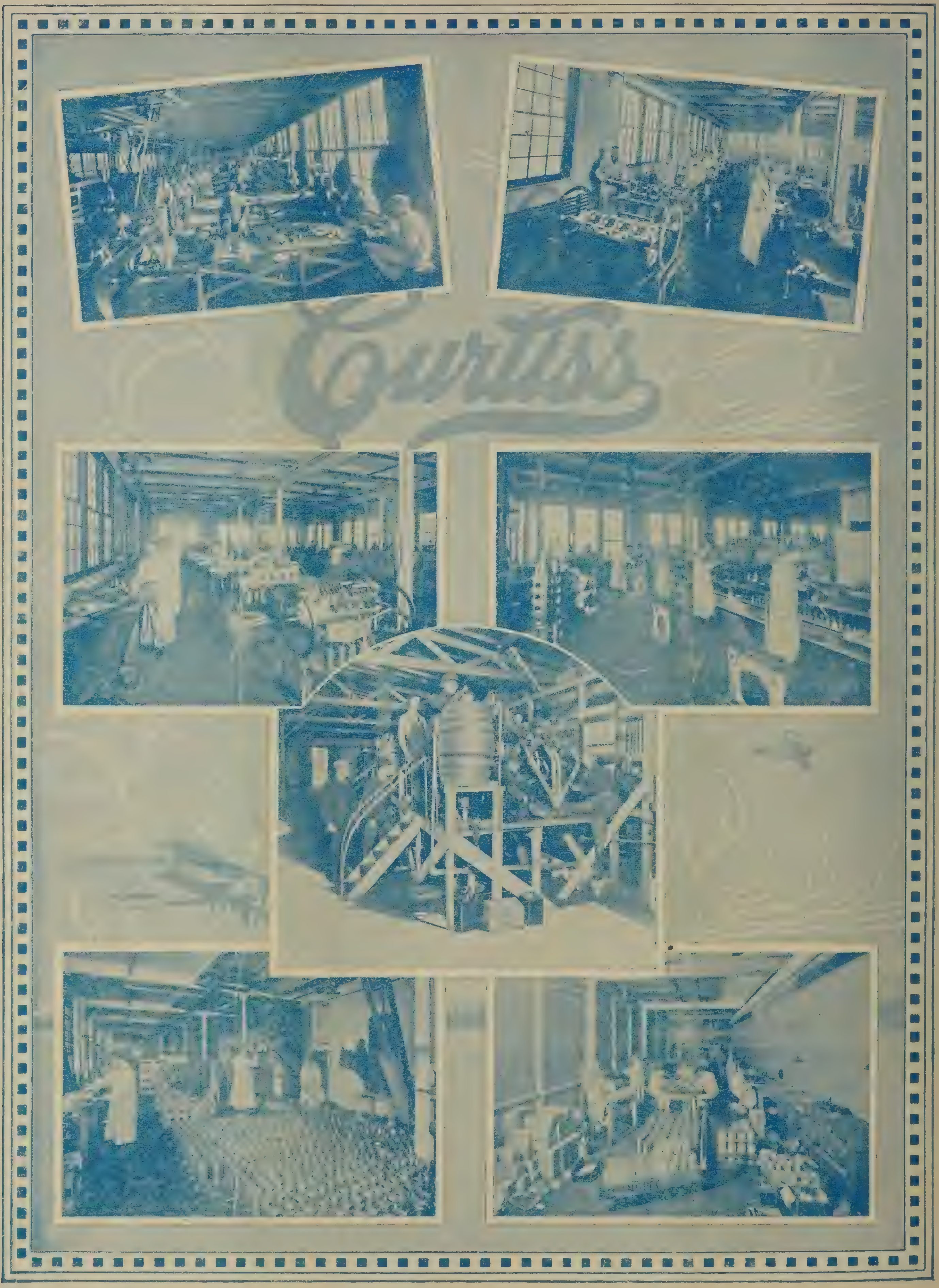

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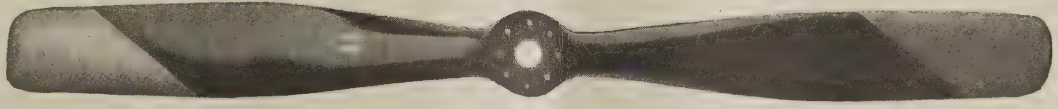

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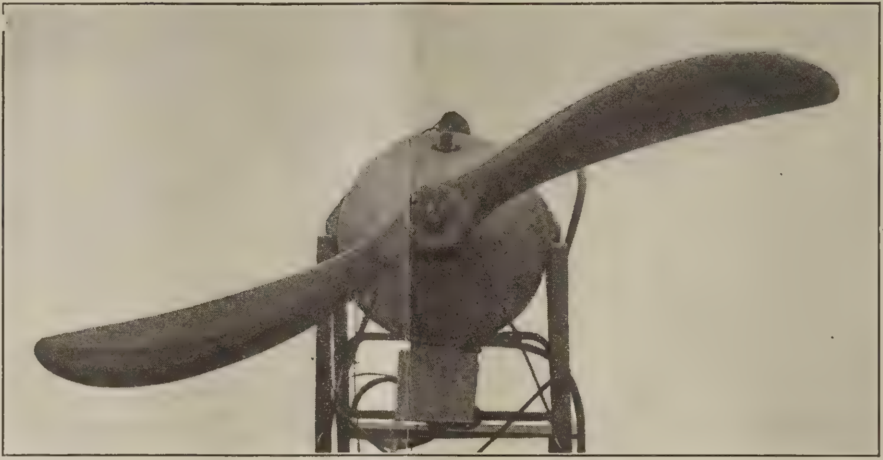

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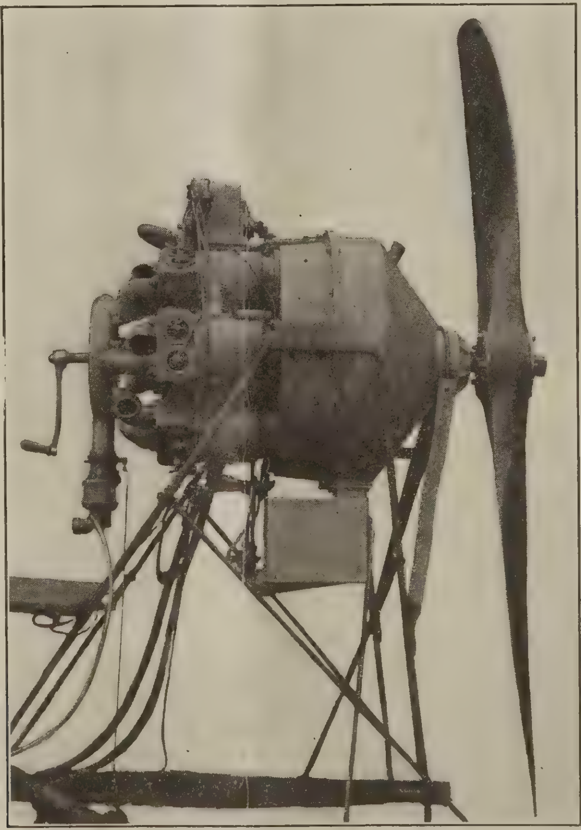

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WEEKLY

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THE TRADE AUTHORITY

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VOL. V NEW YORK, JULY 9, 1917 No. 17

WHAT MUST BE DONE TO INSURE AIRCRAFT PRODUCTION ON AN ADEQUATE SCALE

TO insure aircraft production on a large scale is the one thing that must be considered now, and action must be taken without delay.

We need 100,000 aeroplanes to save the Allies from defeat and there is no doubt that unless we turn them out fast we will see the war at our shores. At all events, every day lost means lengthening the war probably by many weeks, involving loss of tens of thousands of lives and billions of dollars. Every aeroplane today is worth one hundred next year or the year after. Hence, we must act, and act quickly.

One Hundred Thousand Aeroplanes Needed to Permit Major Operations Against German Fleet and U-Boat Bases at the Same Time as Major Operations Are Conducted Over Land.

Decisive victories against Germany can only be achieved through major aerial operations against the German fleet and U-boat bases at sea, and against the important military centers and bases and railroads on land. Had the United States five thousand army aviators and five thousand naval aviators, and fifty thousand aeroplanes and fifty thousand naval aeroplanes to send to Europe at once, we could look for the end of the war within a year or so. But as we are not in a position to contribute even one thousand aviators and five thousand aeroplanes, Germany will have time to prepare, as she always has succeeded in doing so far, to meet new developments.

In view of her success in destroying the British steamship "Gena" with a torpedo dropped by a hydroaeroplane, and the evident fact that the torpedoplane affords a powerful weapon for aerial attacks on fleets, it is only logical to expect that Germany is preparing to make a torpedoplane attack on a large scale against the British fleet and allied shipping. The only way to delay or prevent such an attack is to force Germany to employ her aviators in repelling the Allies' air attacks on land and sea and so prevent her mobilization of hundreds of aviators until the Allies have themselves succeeded in getting sufficiently large air fleets for major attacks.

The Allied authorities are unanimous in their belief that unless the United States can supply the balance of power in the nature of huge air fleets within two or three years, the war may last five years or more. Developing this necessary balance of power, and thereby shortening the war and saving thousands of lives and billions of dollars, requires the adoption of a program which will supply to the Allies not less than 100,000 aeroplanes for land and naval operations.

Rear Admiral Bradley A. Fiske, after discussing the situation with the Allies' foremost strategists, has pointed out that unless we promptly adopt a substantial program to supply the thousands of seaplanes needed for naval operations, we may find that Germany will take advantage of the opportunity and strike a severe blow at the British fleet, thereby freeing the German fleet and enabling it to attack the world's shipping without restraint. Therefore, either while we are considering the building of 100,000 aeroplanes for land operations, or soon after, we must consider the necessity of building 50,000 aeroplanes for naval operations.

Great Britain Spending $40,000,000 a day; Italy Has Already Spent $20,000,000,000. Spending $2,000,000,000 in Huge Aerial Program Would Be Most Economic Way of Winning War.

England has been spending $40,000,000 a day in the war and Italy has already spent $20,000,000,000. Compared with the cost of even only one week of war on the present basis, the cost of carrying out the program of building 100,000 machines for land operations and 50,000 for naval operations is insignificant, and that does not take into consideration the value of the thousands of lives that will be saved by bringing this war to an end.

When we pointed out that this country could be made first in aeronautics within two years, we pointed out that that could be done by coordinating the aeronautic resources, bringing about the cooperation of the bodies and organizations working for the developing of aeronautics, and the concentration of efforts of all interested in aeronautics and national defense.

Coordination, cooperation and *concentration,* which was the motto that we suggested for the aeronautic movement, must now be intensified. We must now have the coordination of the *national* resources, the cooperation of all bodies and organizations interested in *national* welfare; and there must be an intensified concentration of efforts—the *nation's* efforts—to one end—to get a decisive victory against Germany by striking a decisive blow at Germany through the air.

The Aircraft Production Board has already taken steps to coordinate the national resources. The Aero Club of America and its constituent aero clubs, the National Aerial Coast Patrol Commission, the Senate Committee which held the hearings on the Sheppard-Hulbert Bill and the Aircraft Manufacturers' Association—these organizations and bodies, with the assistance of the press, have, in the past four weeks, aroused nation-wide interest in a stupendous aeronautic program. This program has been welcomed enthusiastically, not only by the American public but also by our Allies. It is, in fact, the one hope that the Allies have of striking Germany quickly and effectively.

Quantity Production the Important Thing

Quantity production is now the one important thing—the one thing over which there must be no loss of time, no confusion or squabbling. In fact, the situation is so serious that there must be no waste of time in considering unproven theories, details which fastidious theorists are apt to bring up, and there must positively be no waste of time in squabbling over matters of departmental jurisdiction or misunderstandings. There is no time for misunderstandings.

The Seven Most Important Factors in Quantity Production of Aircraft

Coming down to details of producing aeroplanes in large quantities, there are some essentials which must be defined, else there will be confusion. The seven most important factors in producing aircraft in large quantities are as follows:

(1) Placing orders for continuous deliveries over a period of three years:

To make it possible for manufacturers to develop their production facilities in proportion with the needs, the Government must place orders for aircraft extending over a period of three years, the types of machines to be built to be subject to change, but the orders not to be subject to cancellation, except in the event of the war ending, when the Government may cancel the orders, indemnifying the manufacturers for any losses involved. As the Government has it in its power to limit the profits and regulate the operation of factories, the Government will not be involved in losses in adopting a three years' program of construction. In this way it can build an efficient and sufficient manufacturing machinery which will make it possible to turn out the thousands of aeroplanes needed to give the Allies the balance of power.

(2) Adoption of standard types of machines and motors:

Types that have already been proven successful should be adopted and produced without attempting any changes until better types have been developed in the experimental department.

To train the thousands of aviators in France, England, Canada, as well as in the United States, there will be needed thousands of machines of the "penguin" type, and tens of thousands of the advanced training type. The Allies have already agreed on the adoption of the Curtiss J-N type for advanced training, and will need tens of thousands of these. Then there are needed thousands of training machines for the training of naval aviators, and tens of thousands of the small combat type; of the large three passenger armed machines now being used for photography, "spotting" artillery fire, reconnoitering, and other purposes; and of the very large bombing machines capable of making long distance raids. For the naval operations there will also be needed thousands of medium sized machines for aerial coast patrol work and for long distance bombing raids, as well as large torpedoplanes and seaplanes for long distance bombing raids.

(3) Experienced aeronautic engineers and aeronautic constructors:

Experience in aeroplane building is a most valuable factor, and every aeroplane plant that has manufactured aeroplanes, no matter how small the production, should be given orders large enough to permit expansion of manufacturing facilities to the fullest extent.

(4) Experienced men in quantity production are needed to create large sources of supply for aircraft:

To avoid the failures experienced by large production firms, who have taken up the manufacturing of aeroplanes and motors in the past, arrangements should be made to combine the experienced aeronautic talent and the experienced production talent. Manufacturing facilities without aeronautic manufacturing experience will result in failure in efficiency, just as aeronautic engineering experience without quantity production experience will fail in production.

(5) Labor:

The American aeronautic industry today has more trained labor than the British aeronautic industry had in the beginning of 1914, and it should be possible to dilute this trained labor with untrained men and women to take care of the large aerial program now under consideration. In aircraft manufacturing the employment of untrained labor not properly supervised by experienced men spells disaster and means deaths of aviators.

(6) Materials and supplies:

There may be an excuse for our not having dry lumber, aeroplane cloth and other materials needed for aeroplanes at present, but there will be no excuse if we do not have it in six months from now. The seriousness of the situation forbids that we allow the important work of securing materials and supplies to be delayed, and it will avail nothing to the country or to the cause of the Allies to give excuses or justifications for not having the materials and supplies on hand when they are needed. For instance, there are hundreds of millions of feet of spruce available, but it has to be properly dried and it would be too much to ask of lumber dealers to undertake to dry it and get it ready for aircraft manufacturing if the Government does not consider it necessary to take steps to give reasonable assurance to the dealers that the lumber will be used.

(7) Manufacturing facilities:

Manufacturing facilities for aeroplanes are available to a tremendous extent, but not so much for the manufacturing of motors, metal parts, etc. Buildings and machinery are costly and take some time to get. Manufacturers should be given assurance of orders immediately so that they may be able to get manufacturing facilities.

It is well to repeat that the one essential thing to insure quantity production is the one thing which only the Government can supply and which it never before did supply, and that is large orders for aircraft extending over a definite period, for the largest production possible, but without penalization of manufacturers or red tape obstacles.

The orders must extend over a definite period of time and every effort must be made to prevent the waste of manufacturing facilities such as there has been, due to the fact that new orders are seldom given until other orders have been completely filled. This practice of waiting until an order has been completed before giving another order forces a manufacturer into practical idleness for a period of time that has often extended to weeks, involving an irreparable loss of production to the country and a serious financial loss to the manufacturer.

For instance, owing to lack of funds, the aeroplane manufacturers have been kept practically idle for the past two months, having no Government orders—although the entire country and our Allies know that the number of aeroplanes which have been lost thereby may mean the difference between victory and defeat. This must not happen again. Every manufacturer who can turn out aeroplanes, no matter how limited his present resources, should be given orders to manufacture either the machine which he is producing, or the type adopted by the Army and Navy, the orders to be large enough to enable him to expand his facilities. This should be done with every manufacturer of aeroplanes, motors, dirigibles, balloons, propellers and parts.

Penalizing the manufacturers for failures on time deliveries must be abolished, as it has been abolished in Europe. Supposing a company that has been given an order for 10,000 aeroplanes delivers 90 per week instead of delivering 100. It certainly should not be penalized for that. Those in charge must realize that every manufacturer is as much part of the national machinery as the officers of Federal Departments themselves, and whereas profits are to be limited the Government must protect the manufacturer against losses. Unless this is done the manufacturers will find it necessary to curtail their expenses or quit business, either of which means loss of production to the Government.

As to profits, the American Government should follow the example of the British Government and give every opportunity to the aeroplane manufacturers who have been developing aeronautics at a deficit for so many years, to make up for their past losses.

The British and French Governments very justly and wisely also gave an opportunity to every small aeroplane manufacturer to develop his facilities. In many cases manufacturers who were barely capable of turning out one machine per week, were given orders for several hundred aeroplanes, to be built on Government specifications, and that enabled them to develop large factories in a minimum period of time.

In the training of aviators, the saving of time is also most important. Sufficiency is the first element of efficiency, and to get sufficiency in aviators means that the training schools must be kept going every minute between sunrise and sunset. There must positively be eliminated that waste of time due, for instance, to not having an extra shift of mechanics to get the machines in order after the day's flying is over, to have them ready for the following morning. Unless this is done, the best part of the day is lost in waiting for the repairing and tuning of aeroplanes which were used and put out of order the day before. As fair weather cannot be purchased, every minute of fair weather must be used for training—and reasonably bad weather can be used for advanced training, so that military pilots may be able to fly under war conditions.

Two things should be emphasized: (1) That for warfare there are being used more and more large machines: (2) That the exigencies of war require that everything be done to encourage invention. Therefore, a premium should be placed on developing more efficient machines and nothing should be done that would stifle invention. This war is on such a tremendous scale that 20,000 machines of any one type can be used effectively even if a better machine should be developed in the meantime; but the actual control of the air may always depend on 20% of the machines employed being more efficient than the enemy's machines, whether they be large air cruisers carrying a number of gunners or small fighting machines carrying a single gunner. Invention should be encouraged so that the Allies may always have the most efficient aeroplanes with which to clear the sky of German aviators to permit the other 80% of the aeroplanes to operate unmolested, and the large torpedoplanes and bombing machines needed for major operations.

The Fiske Torpedoplane

At a meeting of the Board of Governors of the Aero Club of America a letter was presented from Rear Admiral Bradley A. Fiske, suggesting a plan for attacking the German fleet and ending the submarine menace.

The Aero Club of America, through its Board of Governors, unqualifiedly endorsed the plans and suggestions embodied in Admiral Fiske's letter, and stated that they believed this to be as among the most definite and promising solutions of the problem yet proposed.

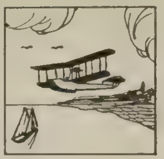
Admiral Fiske's letter, which was addressed to Mr. Alan R. Hawley, the president of the Club, reads as follows:

"My dear Mr. Hawley:

"Referring to my previous letters to you, which pointed out that the United States could give more effective aid to the Allies by means of aircraft than by any other means; referring to the statements that public officials have made during the past two weeks, which show a general approval of this idea; referring also to the fact that more atten-

(*Continued on page* 576)

THE NEWS OF THE WEEK



Board for Study of Aircraft Commerce Urged in Congress

Washington.—The creation of a commission on aerial navigation to study the question of providing for the larger use of aircraft in commerce and in coast defense patrol is asked in a resolution introduced in the House. It was sponsored by Representative Murray Hurlbut, of New York, in the House, and in the Senate by Senator Sheppard, of Texas.

It is suggested that three Senators and three Representatives be named on the commission, together with an officer of the army, an officer of the navy and one civil mechanical engineer. This commission would be directed to investigate the feasibility and advisability of a comprehensive system of aerial navigation for military, naval and commercial purposes.

The resolution also provides that especial study be made of the use of aerial transportation for commercial purposes in the United States, including the service heretofore inaugurated at Atlantic City and at Tampa and Miami, Fla. The establishment of an aerial coast patrol and life-saving service for the defense of the Atlantic, Gulf and Pacific seaboards, and the protection of human life and shipping on the high seas contiguous thereto is also suggested as among the propositions which the commission might consider.

Joy Field Opens July 5

Mt. Clemens, Mich.—The Joy Aviation Field, which was recently sold to the Government, will be known officially as Selfridge Field, and will be ready for aviation work by July 5.

The field will be a replica of the others which are now being constructed throughout the country. It is a 600-acre field and contains 160 acres of timber land, which is being cleared and will be converted to construct corduroy roads over the surrounding grounds.

Work has been in progress for a short time and there are now in course of construction twelve hangars, two aero repair shops, six officers' quarters, six non-commissioned officers' quarters, school buildings, hospital, power house, six barracks, four latrines, quartermaster's supply department, aerial supply depot, and machine shops.

The field will be a complete city with grading, sewerage systems, heating and lighting plants, school houses for the children of its occupants, and so forth.

When in full operation 900 students will be accommodated. The field is named in honor of the late Lieutenant Thomas N. Selfridge, the first United States navy or army officer killed while flying.

Marmon to Make Aero Engines

Indianapolis.—The Nordyke & Marmon Co. expects to manufacture approximately 1,000 aeroplane engines for the United States Government within the next 90 days. Within 60 days the company will occupy a new addition to its plant, which will be 100 by 350 ft. Another building of the same size will be completed in 90 days. Pending the completion of these improvements, the company is proceeding with the manufacture of engines on a large scale. The engines are to be used in aeroplanes that are to be sent to training camps in the Middle West.

1,000 Curtiss Aeroplanes Ordered

Toledo.—Orders for 1,000 battle planes received by the Curtiss Aeroplane Co. will speed up work at the branch factory of the Willys-Overland Co., which is devoting its activities to aeroplane manufacture. Buildings will be erected in connection with the aeroplane business in this city to cost more than $1,000,000. Although complete planes will be built in Toledo with the establishment of a branch Curtiss factory in West Toledo, President John North Willys, of the Willys-Overland Co., stated that they might not be given field tests here.

U. S. Flying Field for Belleville

Washington.—The Signal Corps announces the letting of the contract for the fourth of the new Government flying fields, to be built at Belleville, Ill., 23 miles from East St. Louis. It will be a standard two squadron field, accommodating 300 student flyers, with the requisite number of officer instructors, mechanics and enlisted men, and providing hangars for seventy-two training planes. Construction of the building and the preparation of the field will begin immediately.

The location of the fields already announced are Dayton, Ohio; Mt. Clemens, near Detroit, Mich., and Rantoul, near Champaign, Ill. The Government's present plans contemplate letting the fifth contract in about two weeks, and the remaining four of the nine fields already authorized at successive intervals of two weeks thereafter.

The preparation of the three fields already started has been made an emergency job, and the Chanute Field, at Champaign, is already nearly done. Substantial progress has also been made on the big four-squadron Wilbur Wright Field at Dayton, and the Selfridge Field at Mt. Clemens, Detroit. The authorities hope to have men flying on all three of these fields by the middle of the summer.

New Type Aeroplane

Grand Rapids, Mich.—G. L. McCarthy, a local engineer, is building a midget pusher biplane in collaboration with R. J. Hofmann which will have a new type motor weighing less than 65 lbs. yet developing 28 h.p. The entire plane when completed will weigh only 230 lbs., but according to Mr. McCarthy, will stand a stress of 1,600 lbs.

100 Miles an Hour Up Atlantic Coast

N. Y. C., June 29—Two United States Army aviators left Mineola Aviation Field yesterday morning on their return flight to the Aeronautical Experiment Station at Newport News, Va., after having flown from there to the Mineola field in four hours, at an average speed of 100 miles an hour. They were Captain J. B. G. Bartholf and Lieutenant Stevens, using a regulation army Curtiss biplane.

They left the Hampton Roads field at 4 o'clock June 27, and it was just 8 o'clock when a biplane descended on the Mineola field and the two aviators introduced themselves to the officers in charge there. The line distance from Newport News to Mineola is 383 miles, but Captain Bartholf and Lieutenant Stevens got lost in a fog over Philadelphia and made a detour which lengthened their flight by more than twenty miles.

Therefore they made more than 400 miles in the four hours of flying from Hampton Roads to Mineola. The aviators made the trip at an elevation of about 6,000 feet, crossing Chesapeake Bay just above Cape Charles and following the coast line.

Captain Bartholf and Lieutenant Stevens said that they made the flight as the first of a series of such journeys by army aviators to acquaint themselves with flying over the Atlantic coast.

The two aviators were the guests of the officers at Mineola at the Garden City Hotel on June 27, and left on their return trip shortly after 9 o'clock.

Captain James V. Martin in Government Service

Captain James V. Martin, the veteran aviator, navigator, aeronautic engineer, builder of the first tractor biplane built in America and the manager of the first international meet held in the United States, is in Government service, as a technical advisor. The captain deserves success.

Aeros to Aid Russia

President Alan R. Hawley, of the Aero Club of America, will recommend to the American Government the building of 20,000 battleplanes and the training of 5,000 American aviators for the Russian front immediately, he announced today.

"Russia is fighting blindly," said Mr. Hawley, "and the greatest practical service we can render that struggling democracy is eyes for her army and artillery.

"She has multitudes of men. She has more guns and munitions than is suspected. She is more ready to fight than we know.

"Russia's worst handicap is lack of aircraft. We are the only one of the Allies in a position to remedy the shortage.

"If we can equip the Russians with good aerial eyes at the same time that we overwhelm the Teutons on the western front with our 25,000 aviators and 100,000 fighting planes the crushing power of our blow will be augmented by at least 50 per cent.

"Plans are well advanced for the manufacture of the 100,000 planes and training of the 25,000 men for the western front.

"We can add 5,000 men and 20,000 planes to the programme without much trouble, because our machinery will soon be standardized for immense production."

Hawley's idea is that we should send one air squadron to the Russian front as quickly as possible "for moral effect."

"One air squadron would accomplish wonders in battle," he said, "and it would convince Russia that America is in to fight for and with her.

"One squadron consists of 36 machines, 19 officers and 154 mechanics and assistants. Twelve of the 36 machines are for actual service and the remaining 24 are held in reserve."

Army and Navy Orders

Capts. George E. A. Reinburg and Maxwell Kirby to duty with Provisional Av. School Squadron, San Antonio. (June 6, S.D.)

First Lieut. Stephen H. Noyes to Columbus, N. M., with 1st Aero Squadron, S.C. (June 5, S.D.)

Major John F. Curry, junior military aviator, S.C., from Honolulu to U. S. for further instructions. (June 20, War D.)

The following officers and men of Aviation Section, S.R.C., are assigned to the 1st Reserve Aero Squadron: Major R. C. Bolling, commanding; Capt. Phillip A. Carroll, Adjt.; Capt. James E. Miller; 1st Lieuts. Hobart A. H. Baker, Frederick T. Blakeman, Seth Low, Cord Meyer, Daniel R. Noyes, Edwin M. Post, Jr., Charles Reed and Daniel P. Morse, Jr. Master signal electricians: F. P. Perry, H. E. Bardwell and E. R. Spiegel. Sergeants, first class: G. C. Aaroe, A. B. Craswell, J. J. Claude, Jr., J. H. Coachman, W. K. Donaldson, T. C. Durand, J. P. Fraudin, J. J. Horton, W. J. Norman, Jr., O. S. Reasor, P. E. Schmitz, Le G. M. Van de Water and F. E. Walton. There are also 12 sergeants, 5 cooks, 14 corporals, 25 privates, first class, and 68 privates assigned to this squadron. (June 6, E.D.)

Capt. William K. Wallace, Av. Sec., S.O.R.C., to duty with Chief of Staff. (June 20, War D.)

First Lieut. Earnest L. Jones, Av. Sec., S.O.R.C., to duty at Washington. (June 20, War D.)

First Lieut. Charles J. Glidden, Av. Sec., S.O.R.C., to duty at Balloon School, Fort Omaha. (June 20, War D.)

The Curtiss tractor biplane in which Miss Katherine Stinson made her successful flight from Buffalo to Washington

Curtiss Aeroplane to Sell New Stock at $35

At a meeting of the board of directors of the Curtiss Aeroplane & Motor Corporation, at Buffalo, progress was made in the co-ordination of the Willys-Curtiss interests. John N. Willys was elected a member of the voting trust, succeeding James Imbrie, resigned.

J. E. Keepperley, vice-president of the Willys-Overland, was elected a director of the Curtiss Corporation to succeed G. Meyer.

New orders for aeroplanes and motors amounting to over $20,000,000 have been taken since the last board meeting. This large amount of new business made necessary an addition to the capital stock and the board authorized the issue of 63,000 shares to be offered to stockholders at $35 per share. The new issue has been underwritten by a syndicate. One large stockholder expressed the opinion that nearly all the new stock would be taken by stockholders.

A regular dividend of 3½% was declared on the preferred stock. Plans were discussed for the expansion of the plant and the establishment of the best possible experimental plant under the personal charge and direction of Mr. Curtiss. Mr. Curtiss stated that he is hurrying the designs of a new fighting aeroplane to develop a speed of 150 miles per hour.

Curtiss Aeroplane & Motor Corporation preferred stock dividend of 3½% is payable July 16 to stock of record July 2.

Both preferred and common stockholders of record July 3 will have the privilege of subscribing to 63,000 shares of new common stock at $35 per share. There are 60,000 shares of preferred outstanding, par value $100, and 150,000 shares of common of no par value. New stock will therefore be apportioned in the ratio of 30% of the old shares held.

Madison Barracks Men for Air Service

Madison Barracks.—Twenty-three student officers here, a majority of whom come from New York City, have passed the unusually rigid physical tests required and have been approved for the Aviation Corps. The men were ordered to report to Cornell University for instruction on the school ground.

Flying Boats for Allies

Twenty-five of the giant flying whales which Glenn H. Curtiss lately devised have been ordered by the French and British admiralties for immediate construction. The price aggregates $1,500,000.

The flying whale is a development of the Curtiss invention of the flying boat. Mr. Curtiss has made several changes in the design of the craft and the present order of twenty-five is to bridge the gap between the old order and the completion of tests with the later model.

The whale is used by Great Britain and France in submarine hunting, in coast patrol along the English Channel and the open seaports. It has a wing spread in excess of 90 feet, the boat body is more than 46 feet long and the whole craft ready for flight with fuel and oil tanks loaded weighs nearly two and a half tons. Machine guns, anti-aircraft guns and bombs can be carried.

"It has been stated frequently that the foreign machines are faster and more sensitive to control than those made in the United States," Mr. Curtiss is reported as saying, in the N. Y. "Sun". "It is possible for our firm and for others in the United States to make flying machines for fighting purposes which will exceed any performance by those used in the French and British armies.

"The fastest speed that has been claimed by the British and French engineers has been 127 miles an hour. Lately I have developed a combat machine which will fly 115 miles an hour. This is a triplane with streamline struts. With the present engine in it it has sped through the air at the training grounds at the rate of 125 miles an hour. Under way we have a combat triplane of slightly different design which under normal conditions should do 145 miles an hour.

A group of interested witnesses of a recent test of the Duesenberg motor. Left to right: Rex Wadman, of Detroit; Fred Duesenberg, A. Duesenberg, and Technical Editor Heldt of the Automobile

"The great difficulty we face in the United States is the lack of pilots for high speed machines. Before the aeroplanes now being developed can be used on the fighting lines in this effort to blind the eyes of the German forces it will be necessary first to train fliers for the new combat planes. Engineers are working out that problem by devising rugged training types which will be miles faster than the ones now used."

Rush Work on Hangars

Beech Bottom, W. Va.—Work on the new hangars and the machine shop being constructed on the aviation field at Beech Bottom by the West Virginia Flying Corps is being rushed and the buildings are now about complete. The field is owned by the Whitaker-Glessner company and the material for the buildings has been furnished by this concern.

The equipment for the machine shop has arrived and will be installed without delay. It is the aim of those in charge to have the buildings complete and all equipment installed before the training of West Virginia young men as aviators is started.

J. C. McKinley, one of the promoters of the West Virginia Flying Corps, stated that he believes the training work will be started within a week or 10 days. The flights being made by Louis Bennett, Jr., and Aviator William Frey over the city of Wheeling and other parts of the Wheeling district are merely made for the purpose of giving the machines to be used in instruction work a thorough test before novices are given an opportunity to make their preliminary flights.

Personal Paragraphs

Fred I. Tone is inspector of aeroplanes and aeroplane engines, U. S. Signal Service at Large. He is at present stationed at the Buffalo plant of the Curtiss Company.

Victor W. Kliesrath, for many years chief engineer of the Bosch Magneto Company, has severed his connection with that organization, after a long and successful period as head of the engineering department. Mr. Kliesrath's plans for the future have not been announced.

Past-president Howard Marmon, of the S. A. E., has entered the Signal Corps service actively, devoting his attention specially to aeronautic engine work. R. A. Vail has also entered this corps on special work, investigating manufacturing methods. W. B. Hurley is making a study of metallurgical processes and materials for the benefit of the Corps.

E. V. Rippingille is soon to start the training of the large staff of inspectors which will be required to cope with the production program of the Aircraft Board.

A party of the Aeronautic Division of the National Naval Volunteers en route from Pensacola to Adjutant General's office, of Rhode Island and Squantum, visited the Aero Club of America last week on their way through New York City. The party consisted of the following fliers: Ensign J. H. Walsh, Charles Domler, Wm. Fielder and Corp. M. S. Butcher, 2d Florida Inf., Co. A. They are members of the Second Detail.

Believing it will revolutionize aerial warfare, Frank A. Garbutt, southern California millionaire aviator, is working on an aeroplane motor for use in the coming conflict. Describing his motor, Garbutt says: "This new motor will, I am confident, run 24 hours a day for 30 days and show no appreciable signs of wear. The bearings are very generous, being from five to ten times larger than those of an automobile. The trouble with most air machines is their inability to stand wear and tear of a long flight." Garbutt believes he can make the trip from Los Angeles to San Francisco, almost 500 miles, and back in a day. This sort of air scouting, he says, will prove invaluable in war time.

Aircraft Production Board Confers

The Aircraft Production Board of the Council of National Defense conferred last week with a group of the ablest aeronautic engineers in the country, assembled in a session of the Aeronautic Division of the Society of Automotive Engineers, to work out final specifications for standardized materials and parts which are to be used in the proposed new air fleet. Everything entering into the construction of the engine, belts, screws, nuts, and all kinds of attachments, are being standardized so that the same designs can be submitted to many different manufacturers, permitting them to turn out all parts alike and in quantity to be assembled later at the plants which actually construct the engines and aeroplanes.

Among those present were Charles M. Manley, of the Curtiss Company, chairman of the Society of Automotive Engineers' Aeronautic Division; J. G. Vincent, of the Packard Company, who has been prominent in the development of the new aircraft engine plans; Grover C. Loening, formerly of the Sturtevant Company; Spencer Heath, of the American Propeller Company; H. H. Crane, of the Wright-Martin Company; E. A. Deeds, of the Aircraft Production Board; F. W. Caldwell, Roger Chauveau and Charles B. King, Aviaiton Section, U. S. A.; F. S. Duesenberg, of the Duesenberg Motors Company; Dr. H. C. Dickinson, U. S. Bureau of Standards; Coker F. Clarkson, general manager of the Society of Automotive Engineers; M. W. Hanks, of the S. A. E. office, and A. R. (Roy) Knabenshue.

Aviation Section News

1st Aero Squadron,
Columbus, N. M.,
June 17, 1917.

Classes continue in military instruction for Reserve Officers, radio, practical electricity for sergeants and first aid for corporals.

4th Aero Squadron,
Camp Kelly, So. San Antonio, Tex.,
June 19, 1917.

The week was consumed with routine work and aeroplane assembling.

3rd Aero Squadron,
Camp Kelly, So. San Antonio, Tex.,
June 16, 1917.

Sixteen flights were made during the week with a total duration of 21 hours and 16 minutes. A number of these were across country, with and without stops.

Temporary Aviation School Squadron,
Essington, Pa., June 23, 1917.

Student flying continued active during the week, 117 flights being made, with a duration of 42½ hours, and two Sturtevant seaplanes arrived and were set up. A number of privates in the Aviation Section, Signal Enlisted Reserve Corps, were transferred to Cornell and Ohio State Universities for ground instruction. The Board continues to receive enlistments for flying and non-flying duty, Aviation Section, Signal Officers Reserve Corps.

Standard Aero Photographs

In response to requests on the subject, Aerial Age announces that the excellent photographs used in the educational advertising of the Standard Aero Corporation were taken from the motion picture film made by the Universal Film Mfg. Company.

Two of the training machines of the Beam School of Aviation

American Flying Unit Arrives in England

London—A small contingent of the United States Flying Corps arrived in England June 25, wearing civilian clothes with blue silk armlet bearing white letters "U. S. Flying Corps."

Says Aircraft Will Win War

When Orville and Wilbur Wright built and flew the first man-carrying flying machine, they believed they were making wars impossible. Now, with the greatest war in history at a deadlock because of the equality of aerial equipment, a great increase in the allied aerial forces is the one way to end it, Orville Wright asserts. In indorsing the program of the aircraft production board, Mr. Wright declares that "if the Allies' armies are equipped with such a number of airplanes as to keep the enemy planes entirely back of the line, so that they are unable to direct gunfire or to observe the movement of the allied troops it will be possible to end the war."

"When my brother and I built and flew the first man-carrying machine," said Mr. Wright, "we thought that we were introducing into the world an invention which would make further wars practically impossible. Nevertheless, the world finds itself in the greatest war in history. Neither side has been able to win on account of the part the airplane has played. Both sides know exactly what the other is doing. The two sides are apparently nearly equal in aerial equipment, and unless present conditions can be changed the war will continue for years.

"However, if the Allies' armies are equipped with such a number of aeroplanes as to keep the enemy planes entirely back of the line, so that they are unable to direct gunfire or to observe the movement of the allied troops —in other words, if the enemy's eyes can be put out—it will be possible to end the war. This is not taking into account what might be done by bombing German sources of munition supplies, such as Essen, which is only about 150 miles behind the fighting lines. But to end the war quickly and cheaply, the supremacy in the air must be so complete as to entirely blind the enemy.

"The program laid down by the aircraft production board, if carried out, will obtain this result. The business organization and manufacturing equipment of our country offer the facilities for carrying out this program, and I believe that by no other method can the war be ended with so little loss of life and property."

Aerial Route Proposed

Articles of incorporation have been filed in the office of the state corporation commission of Arizona by the Apache Aerial Transportation company, the Southwestern Securities company acting as attorney. The express purpose for which this company is organized is, according to the articles of incorporation, to establish aerial service for transportation of passengers, mail and express matters between Phoenix and Globe.

The incorporators and directors of the company are Wesley A. Hill, A. Reid, Everett Tiller, Viola M. Hill and D. F. Mayfield. Mr. Hill is manager of the Apache Trail Stage company, operating auto stages between Globe and Phoenix. A. Reid is the proprietor of the Reid Investment company, with offices in Miami and Globe. Mr. Tiller was interested in the Watkins Printing company of Phoenix for the past few years, but recently disposed of his interest to act as secretary of the Aerial Transportation company. Mrs. Hill is secretary of the Apache Trail Stage company and Mr. Mayfield is manager of Mayfield Bros., investment bankers of Globe, and also secretary of the New Dominion Copper Mining company.

In speaking of the progress that is being made with this enterprise, Mr. Tiller said:

"We are going ahead in a practical straightforward and determined way, and gaining the confidence of the public. The aeroplane has undoubtedly demonstrated its efficiency and practicability as a passenger-carrying aircraft, and its superiority over the dirigible or Zeppelin types. Prejudices and fears, once strong, are rapidly giving place to confidence and pride as the art of aerial navigation demonstrates its utility, social and economic worth.

"We have men interested who have accomplished many big and worth-while undertakings, and with this organization perfected, the public should feel confident that aerial service over the Apache Trail of Arizona will be established as soon as we are able to get the most efficient machine that can be manufactured in the United States."

Let Contracts for Aviation Tower at Pensacola

Pensacola.—Contracts have been let to the C. H. Turner Construction Company, of this city, for the erection of a big aviation tower for the naval aviation training school at the navy yard. The tower will be 242 feet in height and will cost approximately $26,000.

Wittemann-Lewis Expansion

The Wittemann-Lewis Aircraft Company, of Newark, N. J., to meet the expected expansion requirements of the United States Government, have, with commendable enterprise and farsightedness arranged, when the necessity arises, to take over 174,000 square feet of space near their present plant. Their facilities would give them an output of 300 aeroplanes the first year of such expansion. Later they would be geared up under high pressure to turn out three complete aeroplanes per day, or practically 1,100 aeroplanes a year.

The Wittemann-Lewis tractor biplane gave a remarkable exhibition of both stability and agility at a Government aviation field near New York recently. It was flown by **E. B. Stinson**, the instructor-president of the Stinson Aviation School, San Antonio, Texas, and brother of Miss Katherine Stinson, also one of the proprietors of the school, who recently flew over parts of the country dropping paper "bombs" appealing for Red Cross funds.

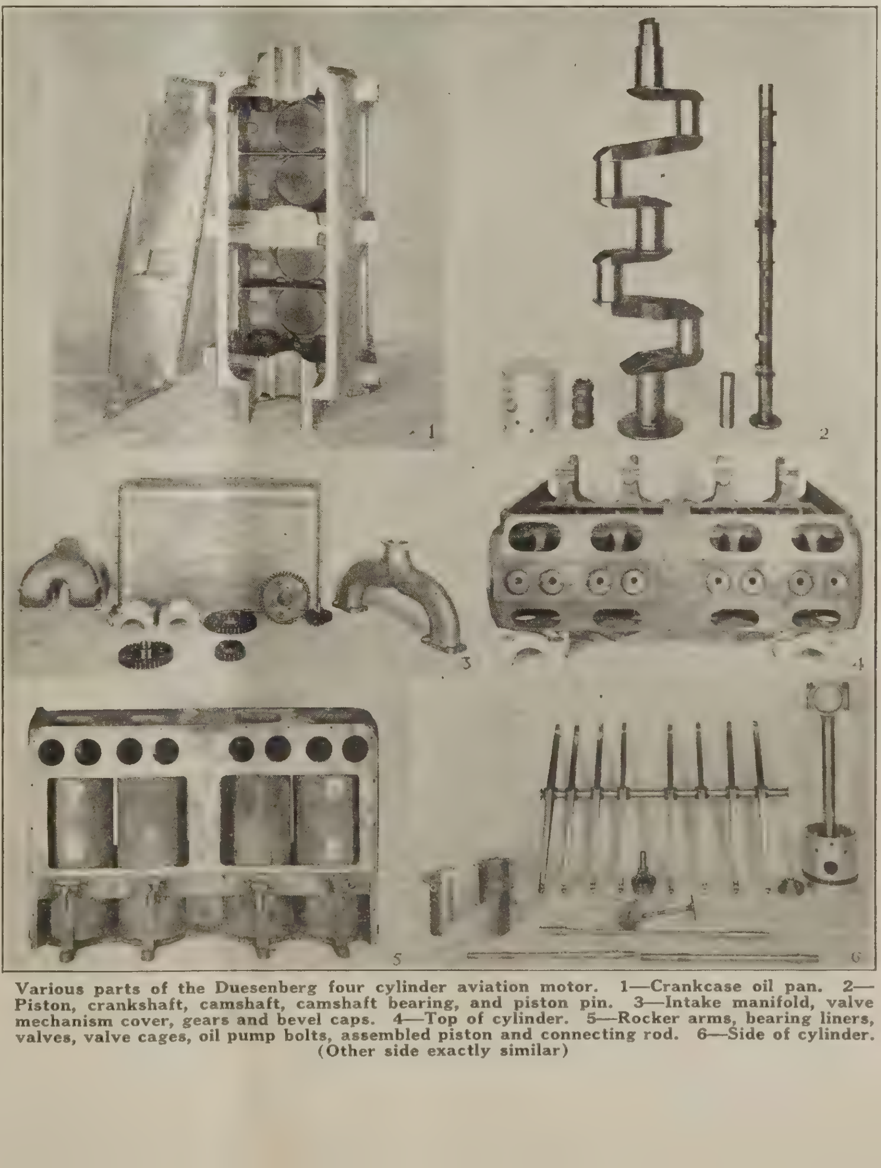
Mr. Stinson subjected the machine to the most rigid tests. One of the most severe and exacting was a rapid descent from a height of 2,200 feet to 1,200 feet and then snapping the machine into an abrupt upward climb. Another maneuver was putting the machine in a banking position and continuously flying it that way in circles. He caused the machine to stand on its tail and apparently fall over backwards. He looped the loop eight consecutive times, beating his own previous record for seven successive loops. The machine described these loops in easy, graceful fashion. They were begun at a height of 2,000 feet and finished at 1,200 feet, so that these eight loops were accomplished within a radius of 800 feet. The aviator purposely stalled his motor, dived and pitched. He flew upside down for 200 feet. He then subjected the machine to a rigid landing test. It is equipped with the resilient Ackerman wheels. Mr. Stinson purposely struck the ground hard without injury to the landing gear or wheels.

The machine has met every specification of the United States Government and it has stood up under severe strain since the day it was put into commission, not a cent having been expended for repairs. It was rushed to completion in time for exhibition at the first Pan-American Aeronautical Exposition held in New York last February. The Wittemann brothers were told that it would be an impossible task to get the machine finished in time. However, the machine was installed ahead of time at the Exposition and was admired for the simplicity of its construction and business-like appearance in its coat of battleship gray. At the close of the Exposition the machine was shipped to the Wittemann-Lewis Aircraft Company's plant at Newark, N. J. Shortly after Aviator Adams flew it from Newark to Mineola. A number of aviators have tried it out and been delighted with its performance.

Aviator Stinson, when he flew the machine, was not making a test, but he subjected it to the most severe treatment—the most severe strain—to all the "stunts" known to aviators. It was the general opinion among those who saw the exhibition that the machine, after the severe usage the aviator gave it, would stand up under the most trying conditions and could be relied upon in any emergency. During the performance of these "stunts" one of the spectators remarked that the machine with such rough treatment would soon be reduced to the scrap heap and some thousands of dollars of invested capital would soon vanish.

Mr. Stinson was congratulated upon his splendid skill as a pilot, which does so much to inspire faith in him as a most competent instructor among pupils at the Stinson School at San Antonio.

Mr. Charles R. Wittemann and Mr. Paul W. Wittemann, president and secretary-treasurer, respectively, of the company, were congratulated upon the wonderful performance of the biplane.



Various parts of the Duesenberg four cylinder aviation motor. 1—Crankcase oil pan. 2—Piston, crankshaft, camshaft, camshaft bearing, and piston pin. 3—Intake manifold, valve mechanism cover, gears and bevel caps. 4—Top of cylinder. 5—Rocker arms, bearing liners, valves, valve cages, oil pump bolts, assembled piston and connecting rod. 6—Side of cylinder. (Other side exactly similar)

HYDROGEN FOR MILITARY PURPOSES

Notes Prepared by Major C. DeF. Chandler, Signal Corps, for Army Balloon School, Fort Omaha

THE production of hydrogen for commercial purposes has naturally been toward the development of methods which insure low cost and the equipment designed is usually for permanent installations. Greatest efficiency in the production of hydrogen for the military service involves processes which permit of easily transportable generating equipment, ample available supplies of chemical substances and purity of gas. It is often practicable for the army to use hydrogen plants of commercial types, shipping the gas compressed in cylinders, so that it is important that officers assigned to the lighter-than-air service become familiar with all practicable methods.

Properties of Hydrogen

Hydrogen is a colorless and odorless gas when pure. Frequently in the manufacture of hydrogen by chemical processes impurities in materials cause combinations of sulphur, carbon and arsenic, which with hydrogen even in minute quantities, produces an odor often incorrectly referred to as that of hydrogen.

Hydrogen is the lightest known gas, having a specific gravity of .0696, which is equivalent to a weight of .005621 pounds per cubic foot at temperature of zero degrees C, and 76 cm. (.001476 grams per cubic centimeter, at zero degrees C. 76 cm.). 1 Gram (15.43 grains) at 0° C. 76 cm. equals 11.11 liters equivalent to 678 cubic inches of hydrogen. One grain of hydrogen at 60° F. and 30 inches barometric pressure equals 46.45 cubic inches.

Compared to other gases, hydrogen is absorbed very slightly in water. At 0° C., the absorption in water is .00192 and at 80 degrees C., the absorption is .00079. Referring to weight in grams H_2 absorbed in 1,000 grams of water. Hydrogen becomes liquid at a temperature of minus 220 degrees C. when subjected to a pressure of 20 atmospheres. No matter how low the temperature, the pressure must be at least 14 atmospheres, and, at this critical pressure, hydrogen liquefies at minus 240.8 C.

The coefficient of expansion of hydrogen due to temperature changes is .00366 per degree Centigrade at a pressure of 100 centimeters of mercury, and between the temperature of 1° and 100° Centigrade. This coefficient of expansion should be particularly noted for the reason that in less than 24 hours, changes in temperature of 72° F. (40° C.) in the north temperate zone are not unusual. A lowering of the temperature 40° C. reduces the volume of gas nearly 15 per cent causing a kite balloon of 25,000 cubic feet capacity to become flabby and have the appearance of losing 3,200 cubic feet of gas.

Boyle's Law states that for a constant temperature the volume of gas diminishes in direct proportion to the pressure, but this applies only to ideal gases, of which there are none. The divergence of actual gases from Boyle's Law does not follow any formula; a curve plotted for any one gas is irregular at various pressures. (See Smithsonian Physical Tables.) Hydrogen is less compressible than indicated by Boyle's Law, while nearly all other gases are more compressible. At normal temperatures and a pressure of 2,000 pounds per sq. inch (136 atmospheres), the quantity of free hydrogen in commercial cylinders of 2,640 cubic inches, should be, according to Boyle's Law, 208 cu. ft. whereas experiments show only 191 cu. ft. (Bureau of Standards.)

Hydrogen will burn in air when the percentage is as low as 4½, the flame traveling upward when ignited below. As the percentage of H_2 increases to 9, the flame will travel downward or in any direction. Further increases in percentage H_2 increase the intensity of the flame propogation, which when very rapid and violent is called an explosion. The flame propagation is increased when the hydrogen is mixed with oxygen not diluted with nitrogen as in air. Examples of this power and effect are occasionally observed when hydrogen and oxygen are accidentally compressed in the same cylinder.

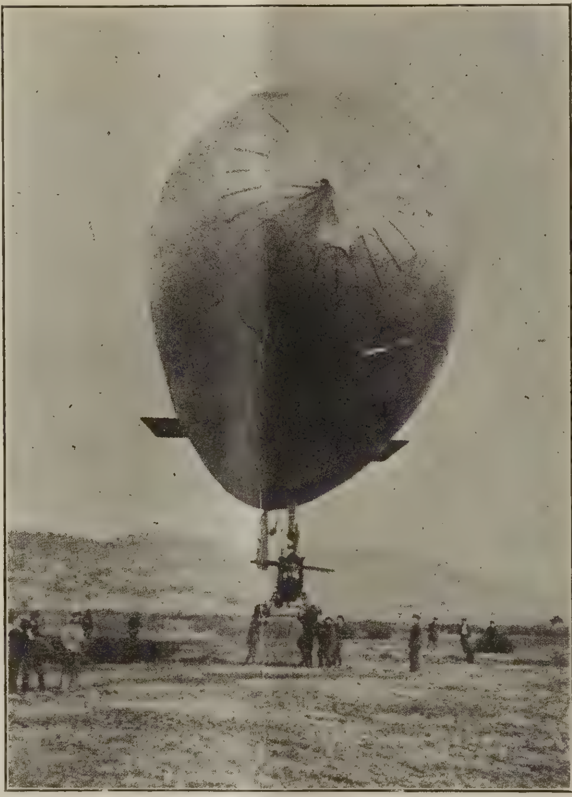
Vitriol Process

One of the oldest and best known methods for hydrogen production is the vitriol process. The action of sulphuric acid on iron or zinc evolves hydrogen as shown by the following chemical reaction:

$$Fe + H_2SO_4 \; . \; Aq = FeSO_4 + 2H$$

It is essential that dilute acid be used for the reason that concentrated sulphuric acid forms a film of sulphate of iron on the surface, which is soluble in water but not dissolved by the concentrated acid. This process is so well known that a detailed description here seems unnecessary. The generating equipment can often be improvised by using substantial barrels or vats of wood or large glass or earthenware carboys, and lead pipes for conducting the acid. The caution to always pour the acid into the water and never the water into concentrated acid can not be repeated too often. Furthermore, when using improvised equipment or even specially constructed generators that are not positively gas tight, never strike a match or carry an open light such as a lantern near the generators.

It is found in practice that the washing and purifying of the gas by the usual methods does not entirely remove the water vapor carrying traces of sulphuric acid, which is most injurious to rubberized balloon fabrics; for this reason the vitriol process is not favored when it is practicable to secure hydrogen by other processes, but if it must be used then special precautions should be taken such as multiplying the number of washers and purifiers and frequently changing the lime in the purifiers. Fresh unslaked lime is used in the purifier to absorb the moisture charged with traces of sulphuric acid which passes out of the hot generating tanks. The lime (CaO) has a great affinity for water ($CaO + H_2O = Ca\,(OH)_2$) changing it to slaked lime (calcium hydroxite) upon absorbing the water. The lime also combines chemically with the sulphuric acid forming calcium sulphate ($2CaO + H_2SO_4 + H_2O = CaSO_4 + Ca\,(OH)_2$). Greater purity of hydrogen can be insured when the weight of apparatus is unimportant, as in permanent installations, by adding in series more purifiers containing chemical substances such as Caustic Soda ($NaOH$) and Calcium Chloride ($CaCl_2$) both of which have property of absorbing moisture and being strongly alkaline will further neutralize acid which is carried by moisture along with the hydrogen.



Blimp observation balloon about to ascend

In order to determine the quantities of chemicals required to produce a certain quantity of hydrogen by any process, apply the atomic weights of the elements in the chemical equations in the manner shown below; for example, making the object of the computation 1,000 cu. ft. of hydrogen, it is necessary to determine first the number of cubic feet of hydrogen in one pound of the gas. This is found to be about 178 feet by taking 12,388 cu. ft. of air as weighing one pound and considering air as 14.4 times heavier than hydrogen, which figures are sufficiently accurate for this purpose.

Example: $Fe + H_2SO_4 = FeSO_4 + H_2$

$$55.84 \quad (2 + 32 + 64) = 152 + 2$$

Then by Proportion 356 cu. ft. H : 1000 cu. ft. :: 55.84 lbs. Fe : X

$$X = 157 \text{ lbs. iron}$$

Similarly for sulphuric acid, 356 : 1000 :: 98 X

$$X = 275 \text{ lbs.}$$

It is seen from the foregoing that 157 lbs. of iron and 275 lbs. sulphuric acid are theoretically required to produce 1,000 cubic ft. hydrogen, but in estimating or purchasing these materials it is always advisable to increase the amounts by at least 5 and better 10 per cent to allow for impurities in chemicals, incomplete chemical action, and losses of gas due to generators and pipes not being gas-tight in improvised apparatus.

The atomic weight of zinc is 65 and by a similar chemical equation it is found that theoretically 182.5 lbs. of zinc and 275 lbs. of sulphuric acid are required to produce 1,000 cubic feet of hydrogen.

$Zn + H_2SO_4 \; . \; Aq = ZnSO_4 \; . \; Aq + 2H$. $65 + (2 + 32 + 64) = (65 + 32 + 64) + 2$.

At least 5 per cent should be estimated above the theoretical amounts, for supplies of zinc and acid. Zinc usually contains some lead as impurity; the lead is not objectionable, but on the contrary, is said to assist in promoting rapid chemical combination due to galvanic action.

Using only the quantities of iron and acid according to the theoretical computation and assuming the cost of iron turnings at 2 cents per pound and acid at 3 cents per pound, the cost of materials alone to produce 1,000 cu. ft. hydrogen would be $11.39.

Electrolytic Method

Hydrogen of greatest purity is obtained in commercial practice by the electrolysis of water, the hydrogen collecting on the negative electrode and the oxygen on the positive electrode where current enters the cell. A *direct current* of electricity is passed through water in a suitable cell which is provided with pipes for collecting both gases. The electro-chemical equivalent of hydrogen is .0000104 grams per coulomb which in larger units amounts to nearly 15 cubic feet of hydrogen for a current of 1,000 ampere hours. The theoretical electromotive force required to dissociate water into its constituent elements is 1.47 volts between electrodes. Therefore, due to the internal resistance of the call, if the voltage required is 2, then the computation shows that one kilowatt hour of electric power will produce 7½ cubic feet of hydrogen.

The internal resistance of cells increases with the distance between the electrodes, and decreases as the size of the electrode increases. It varies also depending upon the nature and specific gravity of the electrolyte in the cell.

Pure distilled water is a very poor conductor of electricity and extremely high E.M.F. would be necessary unless the conductivity is improved by adding suitable chemicals to the water. Ordinarily, pure caustic soda ($NaOH$) is used, bringing the solution to specific gravity between 1.2 and 1.25 at 60° F. It is found experimentally that 2¼ pounds of chemically pure caustic soda are required to bring one gallon of distilled water to 1.25 specific gravity. This is about 17 per cent caustic soda and is the point at which the solution has the greatest conductivity. Adding more caustic soda increases the internal resistance. Caustic potash (KOH) may also be used for electrolyte but larger quantity is required and the present cost is much greater than that of caustic soda.

There are two general types of construction for electrolyzers, one being the unit type which consists of separate cells, each containing the positive and negative electrodes, connected electrically in series; the other general type being called by various names, "bo-polar," "multiple-plate," and "filter-press" types. These electrolizers are usually constructed by assembling large plates very close together separating the positive and negative electrodes by sheets of asbestos; where 110 volt power is available these generators have 60 pairs of plates. The advantage of the multiple plate type over the unit cell type is principally lower first cost and less

Close view of Blimp carriage. Note the size of the bombs used as skid weights

floor space required. The disadvantages being in greater maintenance cost and difficulty of preventing leakage of gas. Most of the electrolyzers made in the United States, both unit type and bi-polar, utilize a special weave of asbestos cloth as separator for the hydrogen and oxygen within the cell. The foreign-made cells at Fort Omaha have a very fine wire gauze to separate the gases.

The quantity of hydrogen produced by this method is proportional to the amperage passed through the cell. For American made electrolyzers the current varies from 35 amperes to 1,000 amperes, and for the Siemens cells at Fort Omaha the normal current is 1,500 amperes. The E. M. F. required for each unit cell or for one pair of plates in the multiple type will average 2 volts, but depends entirely upon the internal resistance of the cell, which in turn depends upon the size of the electrodes, distance between them, nature and specific gravity of the electrolyte and the temperature. It is observed in practice that in starting the plant when cells are cold the E.M.F. per cell in often more than 3½ volts, which reduces to less than 2 volts after the cells become hot.

As the water in the cells is converted into gas, it must be replaced by pure distilled water. The quantity being 5.76 gallons for 1,000 cubic feet of hydrogen. It is seldom necessary to add caustic soda to the solution and then only enough to replace the very small quantity which is carried off from the cells by the moisture with the hot gases, but even this vapor may be condensed and recovered to some extent by moisture traps of various kinds.

Most manufacturers of electrolyzers in the United States claim an output of 7½ cubic feet of hydrogen per kilowatt hour. As shown in the preceding paragraphs, this means an E.M.F. of not to exceed 2 volts per cell. When it is possible to secure electric power at 1 cent per K.W.H. the cost of 1,000 cubic feet or hydrogen for power alone is $1.57 (assuming motor-generator efficiency of 85 per cent, and electrolizer efficiency of 7½ cu. ft. hydrogen per K.W.H.).

The electrolytic plant installed by the army at Fort Omaha in 1908 consists of 30 large cells made by Siemens Bros. Company, Ltd., London, the normal current being 1,500 amperes and the voltage varying from 4 to 2.2 per cell, depending on temperature. The temperature should be maintained at 150 degrees F. Higher than this is likely to damage the insulation and produce an excess of moisture with the gas. Lower temperature increases the internal resistance and cost of electric power. Each cell produces 23.3 cubic feet of hydrogen per hour, a total of 699 cubic feet per hour for the 30 cells, equivalent to 16,776 cubic feet per day of 24 hours for the plant.

Silicon Process

The production of hydrogen by dropping ferro-silicon into hot caustic soda is, in the French and British Armies, known as the "silicol" method; in Germany it is called the Schuckert process, and for many years the details of it were carefully concealed.

The chemical reaction producing hydrogen is between silicon and caustic soda without any change in the iron. The following chemical equation will serve to explain the process: $Si + 2NaOH + {}_2H_2O = Na_2SiO_3 + 4H. + H_2O$. In Germany it was customary to use pure or nearly pure silicon. In France this method was developed for the military service by Dr. Jaubert; his generating apparatus being designed in three types; viz: Auto truck transportable size, semi-fixed and for permanent installations. Ferro-silicon is used, being more easily secured and at less cost than pure silicon as in the Schuckert generators. The steel industry in this country uses large quantities of ferro-silicon containing 50 to 75% silicon. Experiments have shown that more satisfactory chemical action is secured by having the silicon content 80 to 85%. Commercial caustic soda of 97% NaOH is suitable.

Except in very cold weather the mixing of caustic soda with water produces sufficient heat to start the chemical combination of silicon and soda. It is necessary to agitate the solution constantly to secure best results and avoid sudden generation of large quantities of gas of explosive violence. The solution resulting from the chemical combination is sodium silicate, which may be easily drawn off at the bottom of the mixing tank.

According to the chemical equation, the production of one thousand cubic feet of hydrogen would require 39.6 pounds of pure silicon and 112.3 pounds of pure caustic soda. The actual quantities which should be supplied depend upon the silicon content of the ferro-silicon and the percentage of purity of the caustic soda. An experiment conducted for the army determined that 58 lbs. of 80% ferro-silicon and 125½ lbs. caustic soda would produce 1,000 cu. ft.

(*Continued on page* 579)

Two types of guns used for defense against Blimps and other dirigibles

THE 120 H.P. SIX-CYLINDER UNION AEROMOTOR

By G. DOUGLAS WARDROP

A MOST interesting test of the 120 h.p. six-cylinder Union aeromotor, manufactured by the Union Gas Engine Company, of Oakland, California, was recently made under the supervision of the Army and Navy inspectors, and reference to the test data printed herewith will prove that for general efficiency the performance was remarkable.

Perhaps as a matter of introduction a few words concerning the history of the Union Gas Engine Company and the development of their aeromotor will be of interest.

In 1885 the first Union marine motor was built and successfully operated in a launch, this being the first installation of a commercially successful, reversible, marine gas engine, either here or abroad. The next notable achievement of the company was the perfecting of the make and brake type of electric ignition, such as was used for many years afterwards on automobile motors. In recent years the company has made many marine installations which have been credited as being the largest in the world. The latest of these was of 6,000 h.p.. An idea of the immensity of this engine can be gathered from the following data: Weight, approximately 120,000 lbs.; Length, 45 feet; cylinder diameter, 15¼ feet; revolutions per minute, 200.

In September, 1915, the first Union aeromotor was built. It started off by making a non-stop full power run of 27 hours, followed by a similar run of 50 hours. This motor was a two-cylinder section of the regular six-cylinder Union design. After a few weeks of experimental work the construction of the six-cylinder aeromotor was begun. There were, of course, details to be further refined, parts to be lightened, and experiments to be made, that have kept the engineers busy during the intervening period.

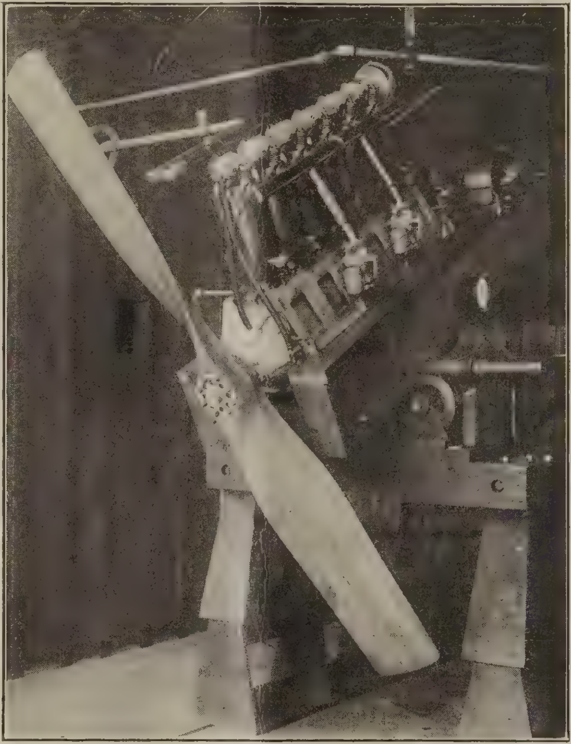
Under direct supervision of Army and Navy inspectors (C. G. Williams, senior inspector in charge) an endurance run of 48 hours was made, beginning May 10th and lasting until May 31st, consisting of eight consecutive, full throttle, six-hour runs, followed by a tilting test. The main test was carried out on a cradle-type dynamometer, with propeller attached directly to the crankshaft, and all conditions made, as far as possible, to simulate those of actual flying. The installation was further made to conform in every particular to the requirements of Army Specification No. 1002.

Quoting from the report of the test:

"The test was performed at the Union Gas Engine Company's factory, Oakland, California, and consisted of 48 hours running made up of eight separate runs of six hours each on consecutive days from May 10 to May 18, inclusive.

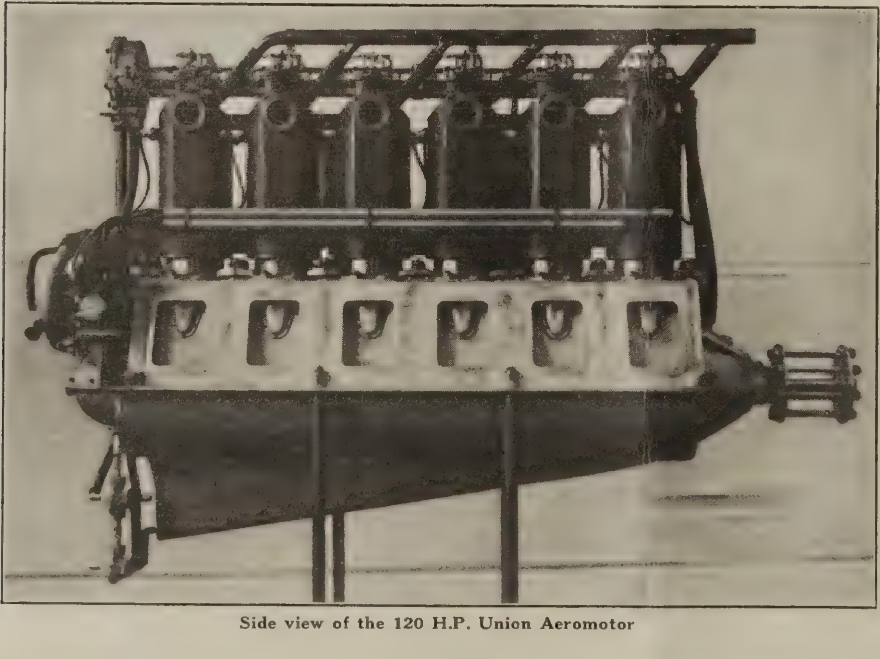
"The engine was mounted on torque cradle frame, pictures and blue prints of this are enclosed. This test stand is of a similar design to that used at the Navy Yard, Washington, D. C. The rated output of 120 h.p. at 1,350 r.p.m. was obtained with a pusher propeller.

"The necessary calibrations were made of the thermometer and pressure gauges to determine their accuracy, also the brake arm radius was checked, the tare weight of the torque stand determined.



The Union aeromotor on the test stand inclined 20° up

"The main test each day was started after a preliminary warm up of five minutes. Readings of all instruments were taken every thirty minutes and the hourly average entered on the Log Sheet.



Side view of the 120 H.P. Union Aeromotor

"The r.p.m. were computed from the readings of a positive continuous counter, stepped down ten times, direct connected to the crankshaft. The torque was obtained from the readings of the spring balance scale. The b.h.p. computed by the standard S. A. E. formula, using the previous noted readings.

"The initial level of the gasoline in the feed tank was marked on the gauge glass. Every half hour the fuel level was brought to this mark, the quantity necessary to accomplish this being weighed and entered on Log Sheet. The summation of these represent the total consumption for the run.

"The oil consumption was obtained by weighing in the initial oil and weighing out that which remained in the tank at completion of each test.

"The engine performed a very satisfactory endurance test. Observations throughout the test showed that the vibrations were low, quick acceleration and good carburetion maintained, also the absence of oil leakage was another good feature as well as no evidence of water leakage at any of the joints.

"The maximum power developed was 123.5, while engine averaged 118 h.p. on last day, with an overall average of 120. Inspection of parts showed that with increase of piston clearance a higher average could be expected as the friction h.p. was excessive, due to drag of two pistons. (See piston inspection.)

"On the fourth day's test, Zeroline Special with a gravity of 20° Baume was used during a portion of the test showing that this engine would perform satisfactorily with lubricating oil varying from 20° to 30° Baume gravity. The average oil consumption was 0.27 gals. per hour or 0.0124 lbs. h.p. hour, which is a good average figure.

"The average gasoline consumption was 10.7 gals. per hour or 0.558 lbs. h.p. hour, while the overall thermal efficiency based on b.h.p. was 0.222. These figures show good carburetion.

"The engine demonstrated that its design and construction was such that it would stand endurance test of a much longer duration as when the run was stopped the engine was functioning very satisfactorily.

"*Summary of Inspection*—The inspection of the engine after the 48-hour endurance test showed that the fundamental design to be such that satisfactory service would be given by this power plant. The quality of the workmanship throughout was of a very high order, and also that the very best of material had been used throughout the engine.

"The above is substantiated by the following points, further details of same being included in inspection report proper:

"1. *Vibration*—All nuts outside of those on the cylinder yoke hold downs were not cottered on. These were not tightened during the test, and all of these were tight as much at the end as in the beginning of the test.

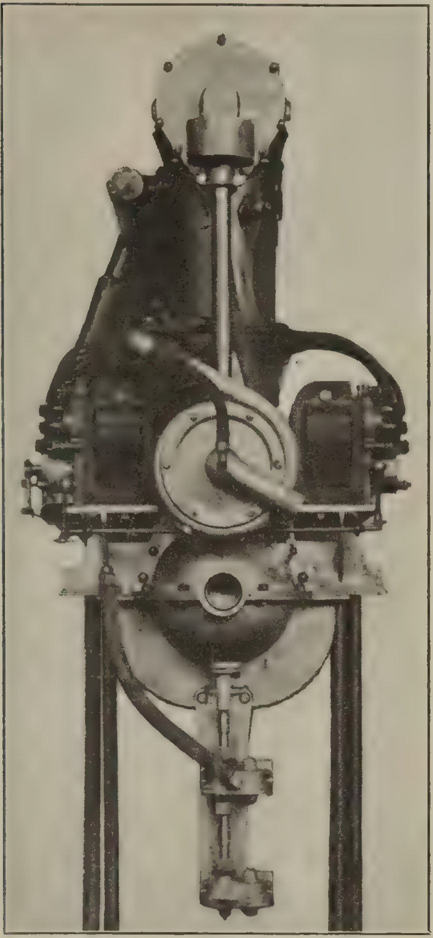
"2. The engine parts were all lubricated and in good shape and there was little evidence of undue wear. Although a high oil pressure of 90 to 100 lbs. sq. in. was carried throughout the run, no serious oil leaks developed, and that from the camshaft around the rocker arms was practically negligible.

"3. *Quality of Workmanship*—The crankshaft was set up fairly stiff and at the end of the test this was checked up. Due to static friction, the crankshaft could not be revolved by applying pull on crankpin. Once, however, the shaft rotation was started by applying pull at a greater leverage it could be kept revolving easily by mechanic, exerting force on pins. This speaks well for workmanship in the initial alignment and fit in the bearings.

"4. *Quality of Aluminum Castings*—The wrist pins, rocker pins, bearings were machined in the aluminum castings and upon inspection the material was found to be of the highest quality.

"5. The bearings throughout were in excellent condition. The scraping marks were still in evidence in crankshaft bearings, showing the load was well distributed and that high-grade bearing material was used.

"6. The cylinders showed slight wear as the grinding marks were not obliterated. These were well lubricated. The valves were not warped, did not show excess heat indication, had good bearing surface, and the wear of the stems were slight. This shows good carburetion and good scavenging. Also, that compression was satisfactory was borne out by well worn



End view of the 120 H.P. aeromotor

surface of rings, small evidence of blowing by, and small deposit of carbon. The latter together with absence of heat shows the cooling of the cylinders and pistons was O. K.

"7. The box shaped under crankcase gives rigidity and strength also in casting the strain will tend to be equalized due to its special construction of compartments with connecting walls, thus perhaps insuring a high quality of casting. The castings of other cases were inspected and bore out this conclusion as the material was clean and of uniform density, taking into account that aluminum alloy was used.

"8. The engine was easily and quickly dissembled."

General Description

Type—Six (6) cylinder, vertical, four-cycle, water-cooled, valve in head.

Power—120 h.p. at 1,350 r.p.m.

Weight—Engine with two carburetors, two magnetos, pumps and water piping, weighs 485 lbs

Cylinders—Cylinders are of steel, with semi-steel head for valves and spark plugs. Base flange integral with walls of cylinder. In test, these cylinders when held by base flange only, withstood a hydraulic test of over 1,200 lbs. per square inch, or a total pressure on the head and base flange of over ten tons.

Cylinder water-jackets are of copper, with brazed joints. Upward thrust of cylinders is taken by chrome nickel studs extending from main journal caps to cylinder flanges.

Valves—Valves are of E. W. P. alloy. Stem guide is long, and water-cooled for its entire length. Valve springs are double, concentric, and of the helical type, right and left-hand.

Rocker Arms—Rocker arms are machined from solid chrome-nickel steel forgings, and heat-treated. Bearings are ¾" diameter and 2½" long. Shape of arms is such that oil leakage is prevented without the use of packing. Excessive wear of valve stem end, caused by point contact of adjusting screw, is eliminated by having line contact in place of point; length of contact between rocker end and valve stem being ⅜". Valve clearance is obtained by use of small cap with thin discs on end of stem. Cap is held by cotter so that adjustment is positive.

Camshaft Housing—Camshaft housing is split horizontally along the center line of the camshaft, permitting easy removal of shaft. To prevent flooding of camshaft housing when climbing, a drain from each end of housing leads down to main crankcase sump.

Camshaft Gears—All valve gears are of Midvale chrome nickel steel, heat-treated and operate in oil bath.

Magneto and Pump Gears—See camshaft gears.

Pistons—Pistons are of Lynnite aluminum alloy. Piston length is 6". Piston pin bearing is 1¼" x 2¾".

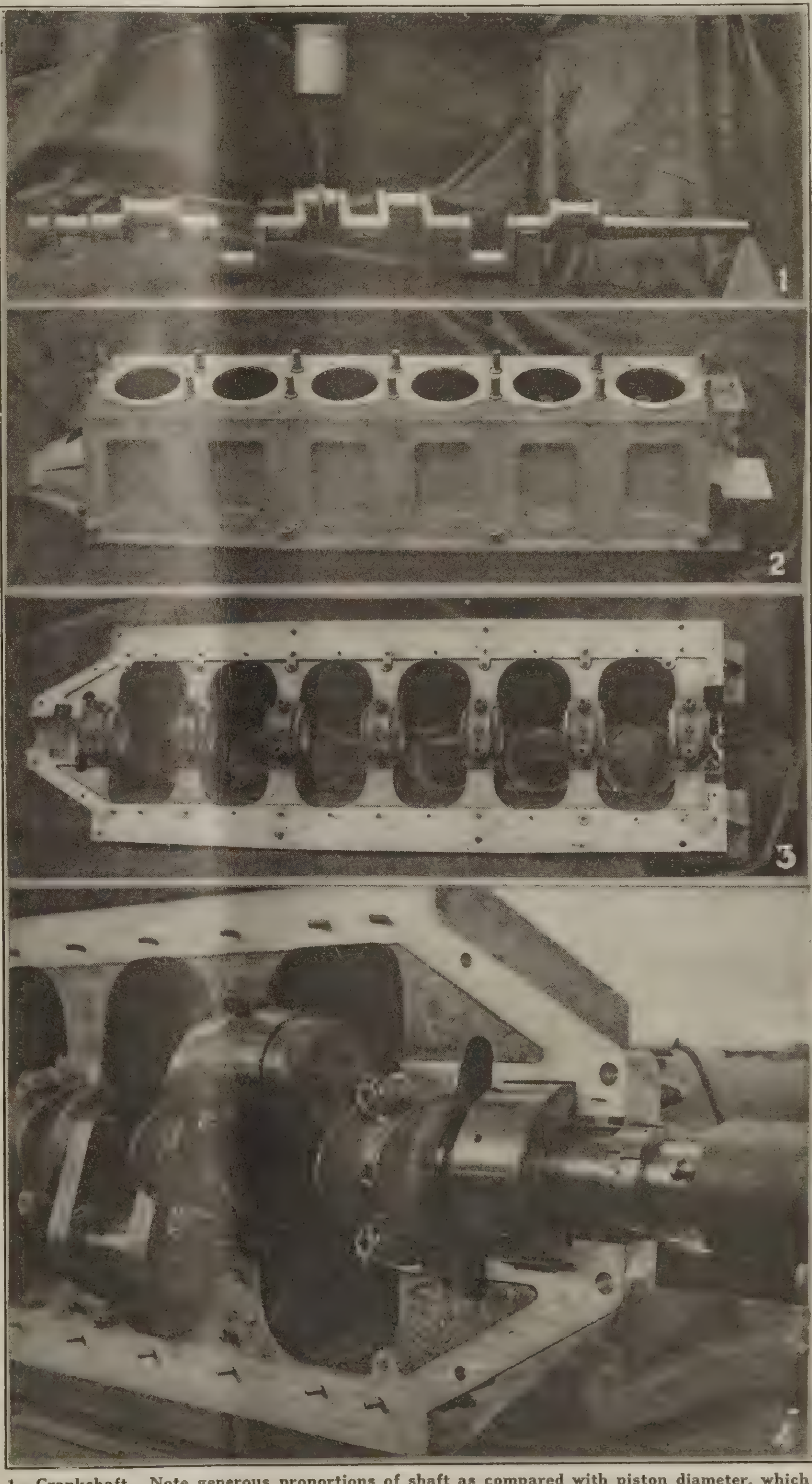
Connecting Rods—Connecting rods are I-beam section, of Midvale chrome nickel steel, heat-treated.

Crankshaft—Crankshaft journals are 2½" diameter by 2½" long; crank pins are 2½" diameter by 3" long. In addition to the seven main bearings, there is a bearing just outside of the thrust. Shaft is made of Midvale chrome nickel steel, heat-treated.

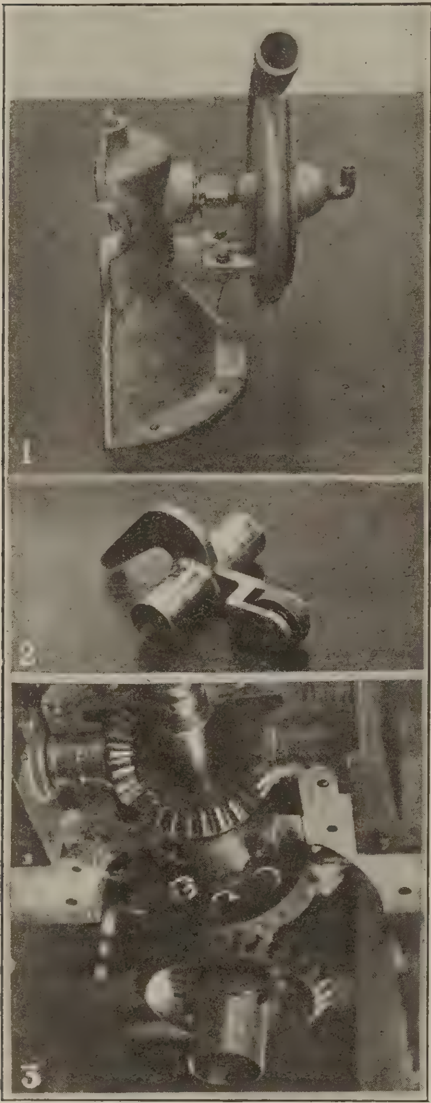
Thrust Bearing—Propeller thrust is taken by a two-way, self-aligning SFK bearing.

Crankcase—Crankcase is of aluminum alloy, and in addition to thorough cross-webbing, the side walls are of hollow box section. The stiffness of this construction is so great that the entire propeller torque can be taken through the length of the case without any signs of twisting or vibration, the case during this test being held from rotating at the end opposite to the propeller end only.

Lubrication—Oil is taken from the crankcase by a gear pump, delivered to a combined oil



1—Crankshaft. Note generous proportions of shaft as compared with piston diameter, which is only 4¾". 2—Crankcase, showing box section wall construction. 3—Crankcase. View before last machining operation. 4—Thrust bearing, S. K. F. self-contained type



1—Water Pump. Mounted on camshaft gear cover. 2—Valve rocker, to prevent oil leakage, arm comes out of top of housing instead of side, thus making it necessary for oil to climb. 3—Gear assembly. Note compact installation of magnetos due to telescope floating coupling

tank and cooler (located where convenient), from which it flows back to a second gear pump which sends it under a pressure of 40 to 90 lbs. to the crankshaft journals, through the shaft to the lower rod bearings and up into the piston pin. The holes in the piston for the piston pin being sealed, the oil must pass between the outer surface of the pin and its bearing. From here it is carried to the cylinder walls. The camshaft, camshaft bearings, cams, rocker arms and valve gears are lubricated by oil by-passed from the oil pressure regulator. This insured force-feed lubrication to all moving parts, even with no oil in the crankcase.

Ignition—Current is furnished by two entirely independent magnetos of either Berling or Dixie make. Each cylinder is fitted with two plugs, each plug being in close contact with a water-cooled wall for its entire circumference.

Magneto Drive—Magnetos are driven through combined driving gear and floating coupling in such a way that there is absolutely no end or radial thrust transmitted to the magneto bearings or armature shaft. Removing four magneto holding-down screws allows the magneto to be readily withdrawn.

Pump Drive—Centrifugal water pump is driven in a manner identical to that used for magnetos, the driving gears and couplings being interchangeable. The pump may be removed by withdrawing its two holding-down bolts.

Intake Manifold—Intake manifold is of copper, all joints and flanges being brazed. Flanges are of steel, held to cylinder ports by four bolts and nuts each. Vertical section above carburetors is water-jacketed.

Crankcase Breathers—A small breather is located opposite each crank brass in such a way that cold air entering case strikes each crank brass, thus having a decided cooling effect. Circulating through these breathers is maintained by a small part of the carburetor air being drawn through the crankcase.

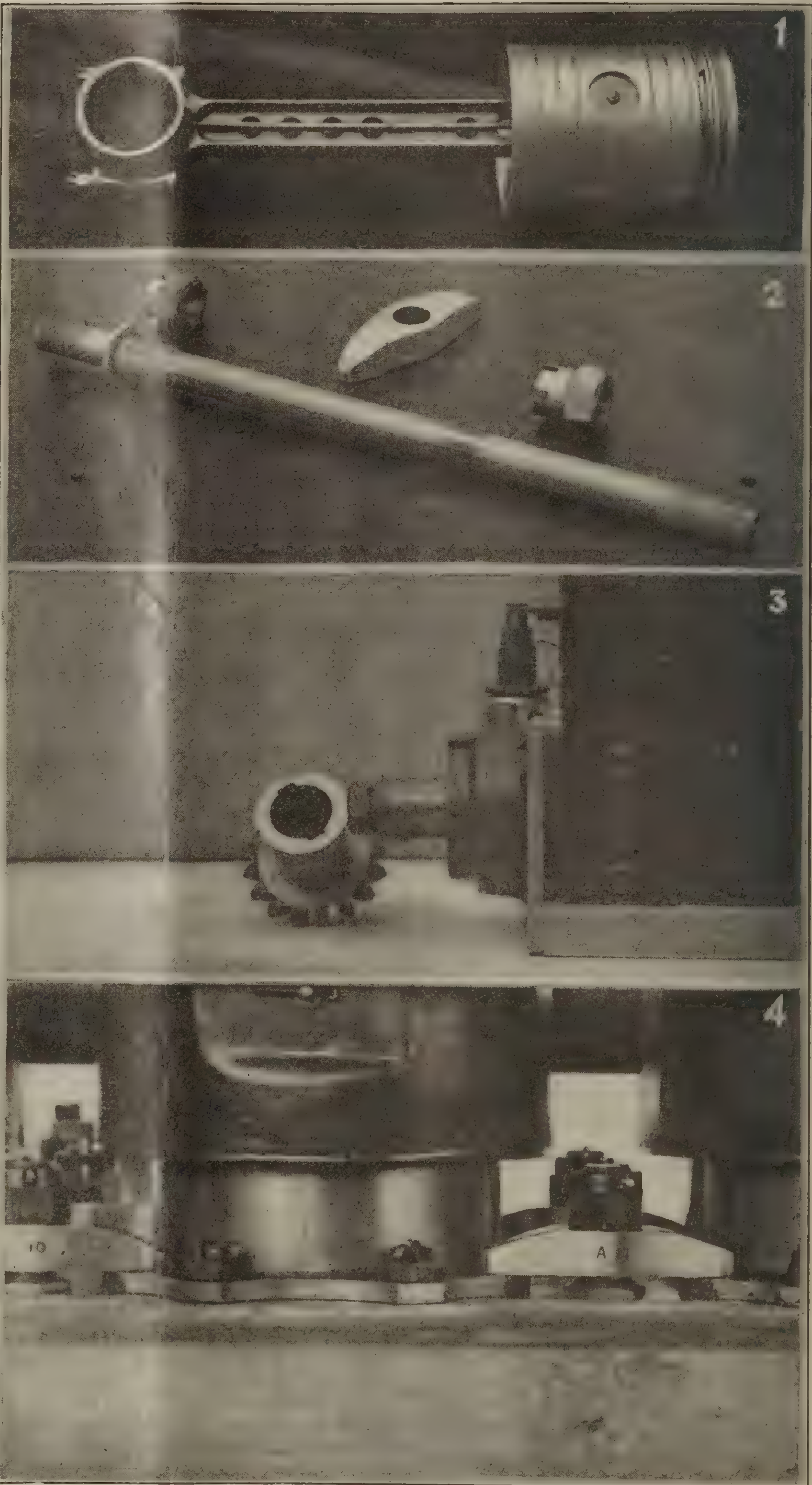
Propeller Flange—Propeller flange may be drawn off of taper by means of special threaded collar between flange and thrust bearing.

Valve Timing—Valves may be quickly timed by means of indicating marks located on flange between thrust bearing and propeller.

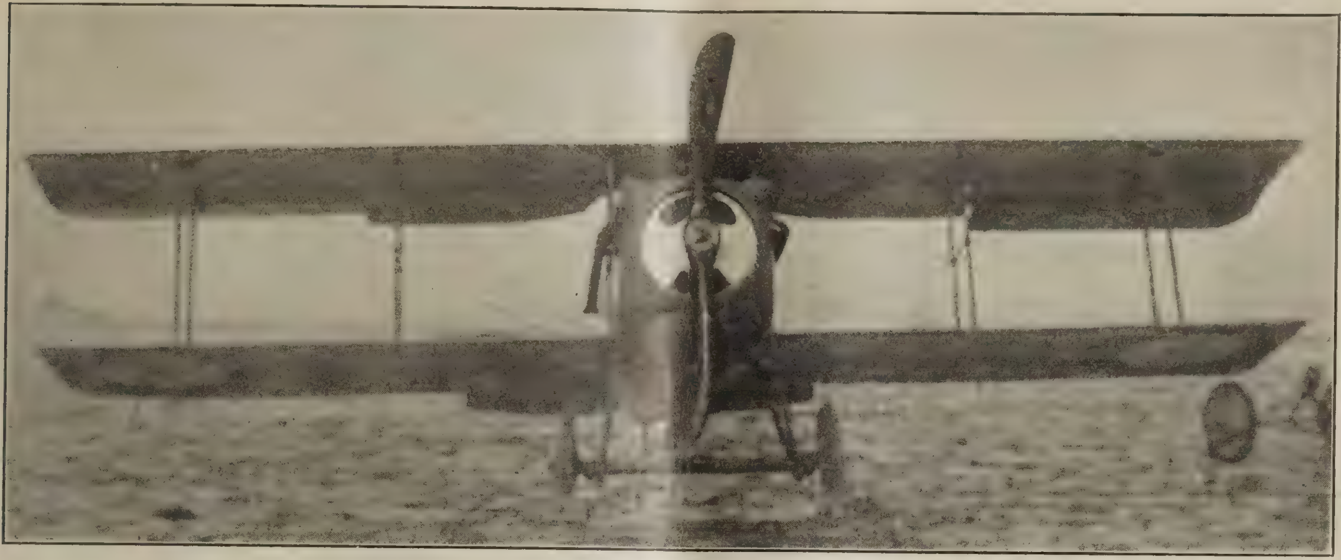
Bolts and Nuts—S. A. E. standard bolt and nut dimensions are used throughout, excepting where extra long threads are necessary as on bearing cap and crank brass nuts. Castellated nuts and cotters are used in place of lock washers. Bolts not so locked are drilled in the head and lashed by means of wire.

Wiring—High tension tested cables from mag-

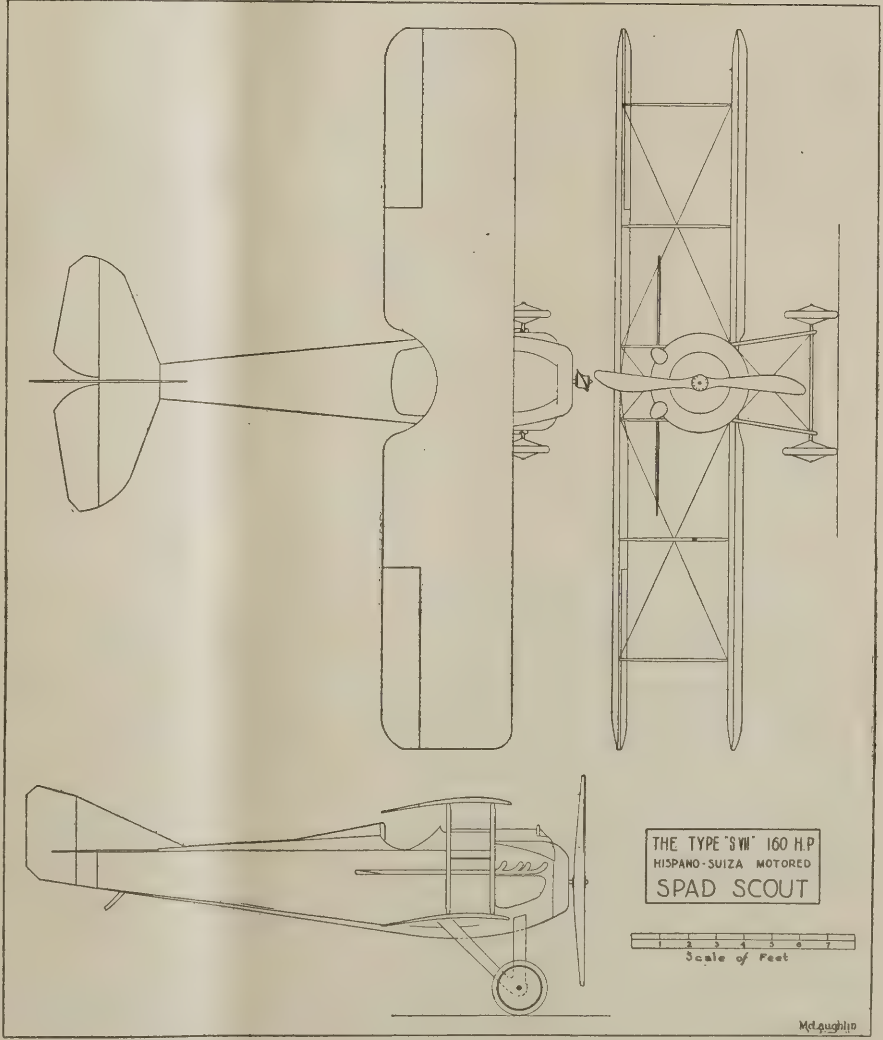
(*Continued on page* 579)



1—Rod and piston assembly. Oil under pressure is delivered to piston pin. Pin is 1¼" in diameter, and is located in center of bearing area. 2—Cylinder Stud. Left end screws into crank case; right end holds journal caps. 3—Magneto coupling. Male member attached to magneto shaft carries two integral feathers which work in featherways in gear hub. All radical and thrust loads are absorbed by gear hub, the magneto shaft being free to float back and forth. Pump is driven by duplicate coupling. 4—Cylinder Studs. Cylinders are held to crankcase in such a way that the case is no time under tension



THE SPAD SCOUT, TYPE S VII.



IMPROVEMENT is so rapid and changes so frequent in the design of the Spads, developed by the "Societé Anonyme pour l'Aviation et ses Derivés," Paris, that the type used within the next few months may differ in several respects from that in use today. The accompanying drawing shows the outlines of the "Type S VII," which is said to be one of the most recent. Fighting craft of this type are piloted by members of the Lafayette Escadrille, and used with good effect equipped with one and sometimes two Lewis or Vickers machine guns.

Approximate general dimensions of the S VII are as follows:

Span, upper plane....	(7.800 metres)	25'-6"
Span, lower plane..................		25'-6"
Chord, both planes....	(1.400 metres)	4'-7"
Gap between planes...	(1.225 metres)	4'-2"
Overall length	(6.100 metres)	20'-0"
Total weight		1,525 lbs.
Useful load		470 lbs.
Climb in 10 minutes...............		9,300 ft.
Speed at sea level...............		132 m.p.h.
Speed at 3,000 metres..............		126 m.p.h.
Motor, Hispano-Suiza V type.....		160 h.p.

Both planes are nearly rectangular in plan, the ends being square and not raked, with corners slightly rounded off. The deep cut-out portion of the top plane, over the pilot's seat, as well as the close spacing of the interplane struts, shows a large area of plane surface aft of rear wing beams. As the ailerons are comparatively narrow, they must be carried on a subsidiary wing spar located about 9 inches back of the main beam.

It will be noticed that the interplane bracing is unusual; the wires from each side of the fuselage extend directly to the end struts, crossing at the intermediate struts. Where the wires cross there is a steel tube brace connecting the forward with rear intermediate wing struts.

The fuselage is exceptionally deep, and the bottom is curved below the lower longerons as well as the sides and top, giving a smooth streamline effect. The fore end of the machine, which houses the motor, is covered with aluminum, with a circular radiator opening which resembles the cowling of a rotary motor. Protuberances on either side of the cowl show where the camshaft covers of the Hispano-Suiza motor project. Perforations are made in the cowling, about the motor projections, for the admission of air.

The rudder is hinged at a point about 10 inches beyond the fuselage termination. The usual fixed stabilizing plane and elevators are employed. The vertical fin extends 12 inches forward of the leading edge of the tail plane.

Wheels of the landing gear have a track of 5 feet; the axle runs in slots which guide it up and backward in line with the rear chassis struts. Shock absorption is with rubber cord.

The Hispano-Suiza motor develops 160 h.p. at about 1,500 r.p.m. Eight cylinders arranged V type, water-cooled four-cycle, 4.7245-inch bore by 5.1182-inch stroke; piston displacement, 718 cu. in. Weight, including carburetor, magnetos, starting magneto, crank and propeller hub, but without radiator, water or oil and without exhaust pipes, 445 lbs. Fuel consumption, one-half pounds of gas per horsepower hour; oil consumption three quarts an hour.

AIRCRAFT AND MOTOR CAR ENGINE DESIGN

Contrasted from the Standpoint of a Designer and Manufacturer of Both Types

By LOUIS COATALEN

THE following paper was read before the Aeronautical Society of Great Britain May 16:

In addressing myself to the members of the Aeronautical Society of Great Britain, the oldest institution of its kind in the world, I have to bear in mind that a section only of that membership is composed of designers of internal combustion engines. Therefore, I have striven to make my remarks this evening as intelligible as possible to those who have not had such training.

At the outset, too, I take the opportunity to thank the Admiralty for giving permission for a paper to be read on so instructive a subject with a view to its being discussed within the limits which it is necessary to impose on a topic of this sort in face of our being engaged in the greatest war in history.

The belief which appears to obtain in some quarters to the effect that the design and production of an aircraft engine is akin to that of a motor-car one proves, on even casual investigation, to be what the old writers would have styled a vulgar error. By taking a few points which come most obviously to mind, we discover at the very outset that the problems involved by the two propositions are fundamentally different.

Chief Characteristics of a Car Engine

Consider for a moment the chief characteristics of an internal combustion engine for motor-car service:

(1) Weight is practically no object.

(2) Cost is of the utmost importance; therefore there must be the minimum of machining, as instance the fact that the connecting rods of a motor-car engine are not milled, nor are the crankshafts machined all over.

(3) It must be capable of production in great quantities at minimum cost; otherwise, with the least amount of labor.

(4) It must be silent to the extreme of what is practicable.

(5) The maximum effort of which the engine is capable is not needed to be maintained for long at a spell. It seldom works at full power, and the brief duration of such effort explains the extraordinary reliability of even the inferior types of car engines.

(6) Flexibility, giving a constant torque at a crankshaft speed from 300 revolutions a minute to 1,600 revolutions a minute.

(7) Of course, this is a torque which corresponds to a very low mean effective pressure, namely, 80 pounds.

(8) The compression is relatively low and the valve area small, the cam forms being easy and the valve spring light.

(9) The system of lubrication wherein the oil is carried in the base-chamber of the crankcase, suffices.

(10) The maximum horsepower required to be developed by any one engine rarely approaches 100. In the vast majority of cases it does not exceed 30.

And One for Aircraft Service

By contrast, the factors governing the design of an aircraft engine may be enumerated thus:

(1) Weight is of prime importance.

(2) Cost is not the deciding factor provided the necessary amount of power is obtained for the given overall dimensions of the engine, and for its weight as regards material and fuel, water and lubricant consumption; and that the desired degree of reliability is obtained.

(3) The amount of labor necessary to produce a satisfactory aircraft engine of high output is, and will be, always many times what is necessary in the ease of a car engine, and is a matter of secondary importance provided the desired results are obtained. No machining is too expensive if it saves weight.

(4) Silence is relatively unimportant.

(5) The aircraft engine does all its work at practically full power.

(6) Flexibility, or constancy of torque, is of very secondary importance, because an aircraft engine is required to work at practically one speed only, or, at most, at an extremely narrow range of speed.

(7) But its working range of speeds is such as to call for a very high brake mean effective pressure, say, 130 pounds.

(8) The compression relatively high and the valve area large, while the valve springs must be stronger than for a motor-car, due to the cam form imposed.

(9) The high mean effective pressure necessary, coupled with the fact of the engine doing nearly all its work at full power, involves a completely different point of departure in determining details of design, and, notably, the exploitation of new methods of achieving lubrication.

Experience has demonstrated abundantly that when the base-chamber is used as an oil well, as in motor-car practice, the lubricant soon becomes too hot, therefore too fluid, resulting in reduction of pressure to the main bearings; hence, the evolution of the dry sump system for lubricating aircraft engines. Oil viscosity varies greatly with the temperature.

Evolution of the Dry Pump Lubrication System

I would mention in parenthesis that the history of the engine dry base lubricating system is neither more or less than the story of my racing experience on the Brooklands track. In the course of long-runs on it years ago, it was found that the oil pressure went down more and more the longer each run was continued. Naturally, we tried one brand of oil after another with the view to discovering which would retain its viscosity most effectively. Of course, castor oil gave greatly superior results to mineral oils. Even so, however, it soon became plain that the problem was one that could not be solved entirely by the use of a vegetable oil. Indeed, results were quite unsatisfactory, notwithstanding that we greatly increased the effectiveness of the pump employed.

Therefore, my next step was to use the same pump to force the oil out of the base-chamber through two 1-inch copper pipes arranged round the car. We returned the oil direct from that process of cooling to the service of the bearings under pressure. This proved a great advance as regards maintaining pressure; but the scheme involved all the inconvenience of a long circuit for the oil in connection with which all the cooling was achieved under pressure, because the oil passed quite round the car before being returned to the bearings.

Therefore, the next stage was to employ two pumps. One forced the oil out of the base-chamber through a cooler, from which it passed into a tank placed at the back of the car. In this tank of oil was not under pressure of the pump, for the tank itself was merely under atmospheric pressure. In practice it was found that this was really a rotable improvement. Thus the bulk of the oil was kept all the time in the tank, which itself was in a draught while the car was travelling, while the base-chamber itself was kept quite empty. From the tank the oil passed to the pump, and was so forced by it into the bearings. Therefore, the oil was under pressure only for a short distance, namely, from the pump to the bearings, because, as has been explained already, the tank itself was under atmospheric pressure.

Only when we had arrived at this stage was it found that racing cars with engines of high output could be run for more or less indefinite periods without the temperature of the lubricating oil attaining more than 66 degrees Centigrade, at which warmth a very good working viscosity was retained.

(10) Lastly, in contrasting the standard car engine, the racing car engine, and the aircraft engine propositions under the headings that have been selected for the sake of illustration, it is to note that the total amount of horsepower required to be developed by practically all aircraft engines today is about 100 minimum, while the maximum totals several hundred horsepower per unit.

Two Distinct Propositions

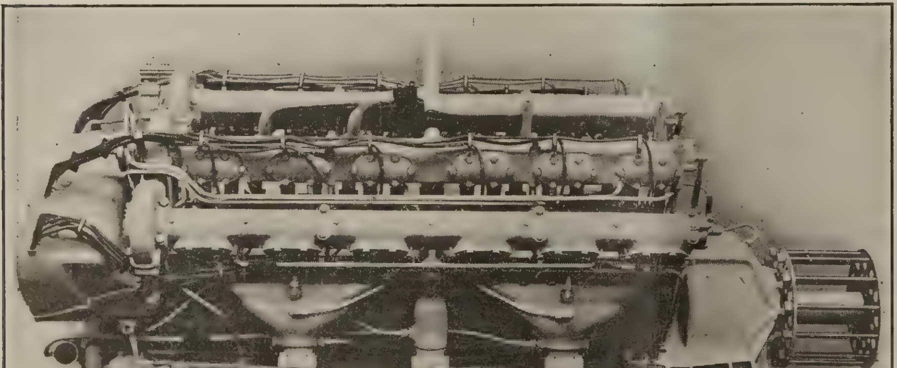
It will be seen from these ten points of contrast which, doubtless, might be increased in number, that the aircraft engine of today is not akin to the standard motor-car one. Admittedly, the twain are collaterals, both deriving from a common stock, the four-stroke cycle, petrol internal combustion engine. For the rest, the aircraft engine of today is, perhaps, as little like the standard motor-car one as that resembles the variety used on a comercial motor vehicle or that installed in a motor-boat. In fine, it may be said, as the stationary gas engine resembles the portable petrol variety to that meagre degree, and scarcely more, does the motor-car resemble the aircraft type.

It cannot be proved that the aircraft engine has been developed from the touring car variety. On the contrary, it can be demonstrated abundantly that the aircraft engine is quite a distinct branch of the development of the internal combustion engine. Hence many firms that have been strikingly successful in producing car engines for either touring or commercial use have experienced great and, in some cases, unsurmounted difficulty when called upon to change over to the manufacture of power plant for aircraft. The differences apparent in the design become even more pronounced when they are translated into manufacturing problems in the shops.

On the other hand, we may not lose sight of the likelihood that the very rapid evolution of the aircraft engine during this war, and the extraordinary manufacturing experience and developments of which that is the outcome, will at some future time exercise a more or less temporary effect on the design and manufacture of engines for car service.

Be this as may be, in broad terms I am of opinion that the two schools of design, one concerned with each of these problems, will continue to advance for the most part along two distinct lines which will rather become more than less divergent. Hence on the present occasion little further attention need be devoted to standard engine design for car practice.

Suffice it to observe that to date the non-technical opinion of the buying public, which opinion is not to be depreciated altogether, has exercised a not inconsiderable and, on occasion, detrimental influence on the designer and manufacturer. It will be observed, incidentally, that this element affects the proposition of aircraft engine design scarcely at all, especially under the conditions which are beginning to govern the industry towards the conclusion of the third year of war.



Side view of 475 brake horsepower, 18 cylinder, water cooled, overhead valve Sunbeam-Coatalen aircraft engine of the broad arrow form. In this arrangement three rows each of six cylinders are fitted on a crankcase. There are six carburetors, each one serving a block of cylinders

The Analogy of the Racing Car Engine

By contrast, there is another type of engine specially built, as distinct from standardized, and which is fitted to a few motor chassis only each year in relation to the total number produced, because it is evolved and employed for racing purposes solely. Admittedly, in the beginnings of the motor industry the racing car of the one year became the standard vehicle the succeeding season.

With the lapse of time, however, racing became so highly specialized that if the individual competitor was to enjoy any prospect of success during the last four or five years the racing engine had become a proposition utterly distinct from those standardized for service or ordinary civilian motor vehicle uses. This point is proved by a summary of the main characteristics required of a racing car engine, and which we find are to a considerable extent identical with those needed for an aviation engine. Thus:

(1) Weight is of importance.

(2) Cost is unimportant.

(3) The amount of labor and the time necessary for production are matters of relative indifference provided the maximum output of horsepower is obtained for a given size of engine. That demand has led manufacturers to employ overhead valves, which are also used in aviation service and which so far have been employed comparatively little in standard car practice, partly on account of the principle not being so quiet in operation as the side-valve system. Every part of a racing car engine must be machined. The connecting rods are milled to the minimum section, and so forth.

(4) Silence is of no importance whatever.

(5) The racing car engine does all its work at practically full power, but the constancy of its torque has to be extended over very much wider ranges of speed than is needed so far in the case of an aircraft engine. From 1,600 to 3,400 crankshaft revolutions a minute is called for in the former case, whereas in the latter the normal speed is 2,100. The last-named figure chances to be no less than 1,100 revolutions a minute slower than the capacity of Sunbeam-Coatalen racing car engines. Therefore, it will be appreciated that the engine for racing car service is submitted to bigger stresses than the present-day aviation engine; but that this period of high stress in the case of the vehicle variety is much shorter than obtains in that of the aviation type unless, indeed, the car is being run on a track. Even in that event twelve consecutive hours is considered a very long spell, whereas in aircraft service that period of uninterrupted power output is held to be all in the day's work.

(6) Under the heading of flexibility the engine for your racing car must be more akin to standard car requirements than to those of aircraft service. This charateristic, therefore, works out as a disadvantage to the racing car engine. When empolyed on dry roads with efficient gears and so forth the starting torque mounts up to a high figure, whereas in the aircraft engine at starting there is no load on the propeller. It increases, roughly, as the cube of the revolutions.

(7) The racing car engine resembles the aviation type in that a very high mean effective pressure has to be obtained with both. In some racing car engines it has arounted to 135 pounds to the square inch, taken from the brake horsepower developed at the flywheel.

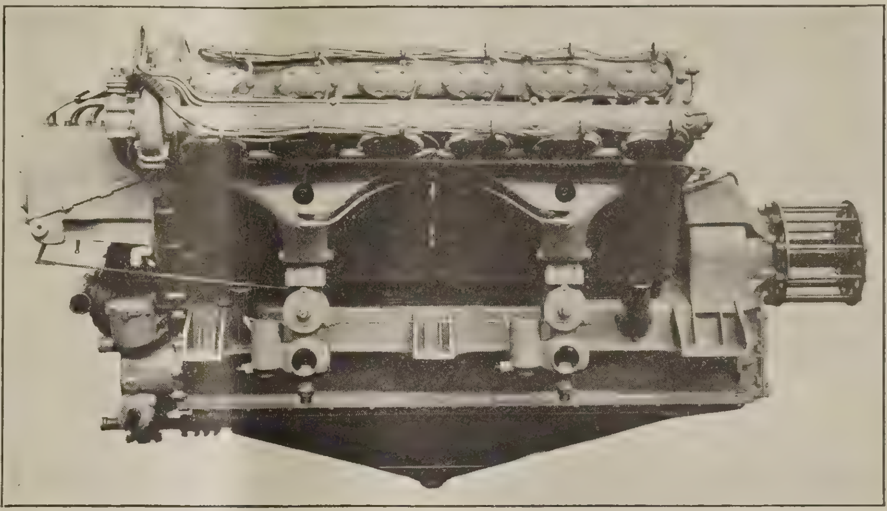
(8) As the problem is power for engine weight and volume, an not silence and low cost, great freedom is allowed the racing car engine designer as regards piston clearances, valve timing, compression, largeness or valve area, strength of valve springs, and so forth, the opportunities in this connection approximating much more to aviation than to standard car engine practice.

(9) The high mean effective pressure necessary, coupled with the fact of nearly all the work being done at full power, calls for lubrication methods quite distinct from standard car practice, albeit as yet these have rarely approximated to that of aircraft engine practice, though the problems of maintaining pressure in the oil circuit and of keeping the temperature of the lubricant normal are common to racing and aviation service.

(10) Comparatively large horsepower is needed in the case of all engines for racing cars, the average being anything from 80 to 225 horsepower, therefore, much more on a plane with the demands for aircraft service than with those for the touring car, the town carriage, or the utility motor vehicle.

Lastly, outside influence, traceable in the case of designing the private car engine and the commercial motor vehicle one, is scarcely, if at all, to be detected in those of the racing car engine and of the aircraft variety. The racing car type has been developed with the utmost rapidity through various stages along the lines of maximum power combined with low, as distinct from minimum, weight, and with the utmost reliability, notably with a view to enabling the machine to be run for long speeds without loss of power.

We might, perhaps, complete our survey of the inter-relationship of these three branches of motor engineering enterprise by adding that in the aircraft engine we have to economise weight considerably over the degree that will suffice for racing car practice, while economy of fuel and oil consumption are also more important in the case of the former than the latter. Admittedly, in the racing car engine those two features constitute a special and important factor, but not one that has had to be studied yet on entirely different lines from standard car practice.



Side view of the 350 horsepower, twelve cylinder Sunbeam-Coatalen engine of V-form, wherein the nose piece is cast integral with the crankcase and the ignition system is duplicated throughout

Accordingly, perhaps we might conclude not unreasonably by stating in general terms that one stage in the development of the aircraft engine is represented by racing car enterprise as well as, perhaps, by certain sporting motorboat work. Endeavors in these directions provided us with the data from which were designed the first engines evolved on the lines to be of such efficiency as the present-day aircraft variety.

In face of our being now in the third year of war, and therefore for the most part somewhat out of practice in the matter of racing car engine design, whereas the leading firms in the industry in Europe have by now accumulated much experience of standardizing aircraft engines, though of recent years none of them have ever standardized any for racing service, it may be said that the data on which aircraft engines are being designed today derives wholly from cumulative experience of aircraft engines, and has ceased to depend in any way on racing car experience.

Indeed, on the coming of peace, doubtless it will be found that the position has been wholly reversed. In the future not a little of racing car engine design may derive from aircraft engine practice.

Desiderata in Aircraft Engine Design

To approach the problem from the correct point of view, we must recognize that the outstanding desiderata in designing aircraft engines today may be summarized thus:

(a) Light weight, combined with low fuel and oil consumption, per horsepower.

(b) Reliability.

If we can but attain those characteristics with units of not less than, say, 200 h.p.—better still, if we can exploit them in units each up to 600 h.p.—then we can afford more or less to neglect other desiderata as being of minor importance. Nevertheless, happily we can already go a far way towards realizing what we might style the minor desiderata, which at this period of the war include:

(a) Simplification to the utmost in fact of these engines being placed, for the most part, in the hands of a great number of semi-skilled men in even flying and maintaining them.

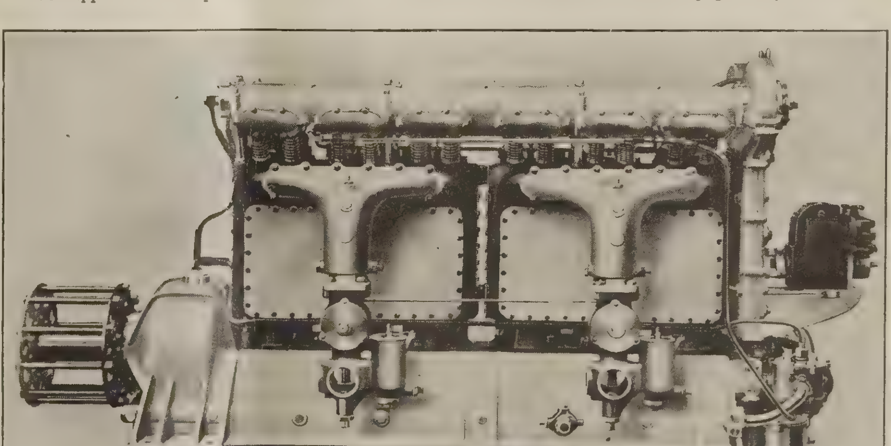
(b) Foolproof as much as possible in that some of the most daring Service fliers either have not the temperament or the understanding to spare the engines of which they are part in charge.

(c) Accessibility, in face of the frequent attention needed by all aircraft engines and of the fortunes of war rendering it necessary on occasion to replace the most vital parts.

(d) Standardization, because for the first time in the story of motor engineering we are making engines of high output in series in place of about half a dozen at a time.

(e) Suitability of exterior form, that the power plant may be accomodated conveniently in the aircraft and occasion the minimum displacement.

(*Continued on page* 579)



The 170 horsepower, six cylinder Sunbeam-Coatalen engine for multi-engined machines, and those wherein the minimum head resistance is desired

MOTO-METER FOR AEROPLANES

THE Moto-Meter Company, of Long Island City, New York, well known as the manufacturers of the Boyce Moto-Meter, now used on the radiator caps of over sixty manufacturers' cars as regular equipment to indicate the motor temperature, have now developed an instrument ideally suited for the use of the aeroplane.

After years of experimenting with the general type of distance thermometers, it was found by Mr. Boyce, that there were four big objections to the average type of distance thermometers which must first be overcome before a practical instrument could be put out for use on aeroplanes.

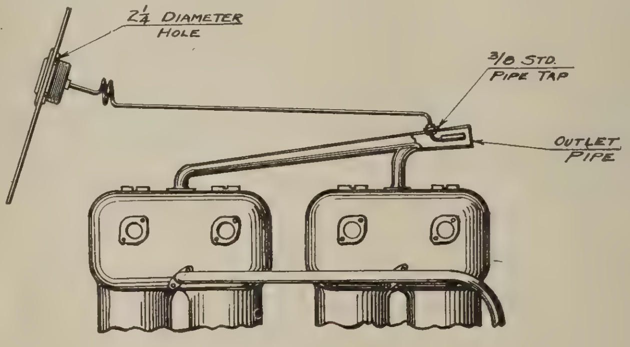
In the first place, it must be located on the dashboard with a radium dial, so that the operator could see it at night as well as by day.

Second, the construction must be such that the vibration of the aeroplane could not affect the readings of the instrument and cause the pointer to be constantly jumping all over the scale. By the construction of the new distance type aero Moto-Meter developed by The Moto-Meter Company, this has been absolutely eliminated and regardless of the vibration existing, the pointer will stay steadily at the exact temperature of the water.

Third, exhaustive tests of the usual distance type thermometers emphatically proves that atmospheric changes from a hot day to a very cold day, would often cause a variation of from thirty to forty degrees in the readings. This point has been so well taken care of by the use of a small piece of thermostatic metal, that it is possible to immerse the whole tubing and instrument in boiling water and then put the whole instrument in a pailful of ice water without in any way affecting the temperature as recorded by the instrument when the bulb is in water of a fixed temperature.

Fourth, another point which had to be accomplished, was to show the operator definitely when steam occurred, regardless of whether he was on the ground or fifteen thousand feet in the air, and as the boiling point of water drops as higher altitudes are obtained at the rate of almost two degrees for every thousand feet, it would stand to reason that the pointer would not show the steaming point at the high altitudes of fifteen to twenty thousand feet at which aeroplanes are now operating, and therefore, it was necessary to develop a special diaphragm which would automatically synchronize the lowering of the boiling point with the decreased atmospheric pressure as high altitudes were obtained. This has been so successfully accomplished that this instrument can be absolutely depended upon to show the steam point regardless of whether the machine is on the ground or is twenty thousand feet in the air.

To develop this instrument especially suited for aeroplane work has required long research and an absolute departure from all former practices, but it is strange to relate that a very simple instrument has been developed to take care of these conditions. The construction of the instrument is such that a small bronze diaphragm is expanded and contracted according to the air pressure entering this diaphragm through the capillary tubing leading to the bulb located at some point in the outlet water flow. This diaphragm in turn actuates a pivoted bar of thermostatic metal which automatically compensates for all temperature changes which occur in the outside atmosphere. As mentioned above, these temperature changes have a marked effect where no thermostatic metal is used.

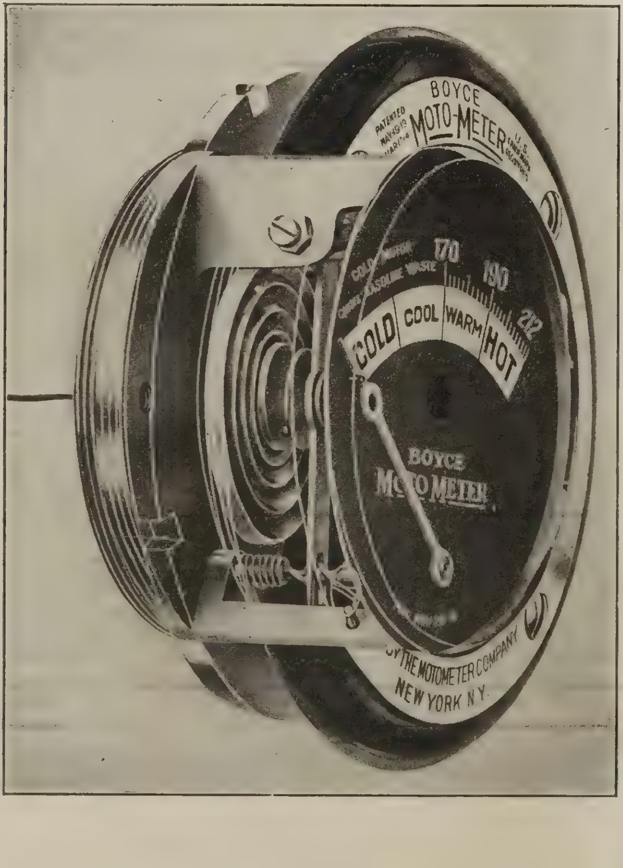


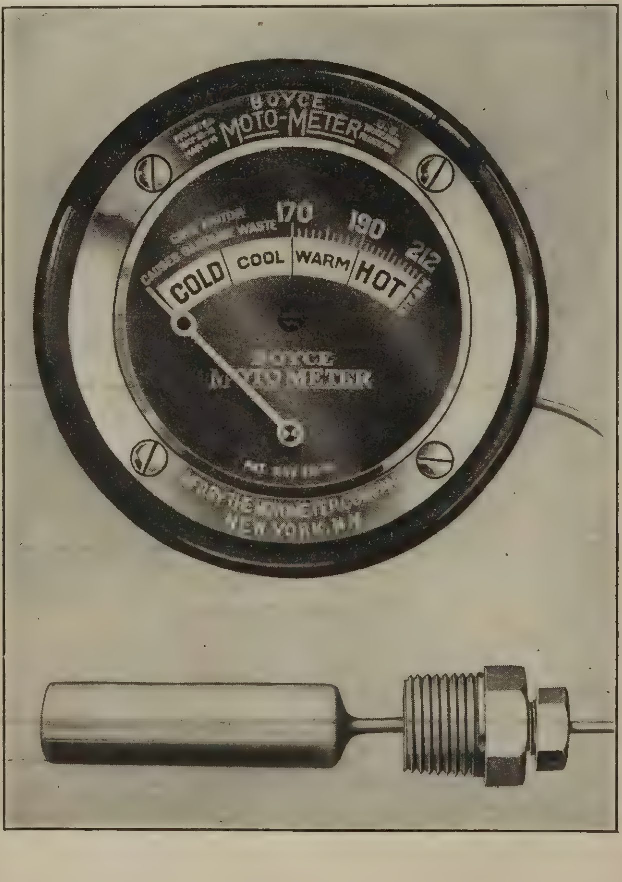
INSTALLATION
OF
BOYCE MOTO-METER DISTANCE TYPE

This thermostatic bar is slotted at the free end and actuates a small twist, on the end of which is located the pointer, which in turn indicates the exact temperatures at which the motor is operating.

This construction, of course, entirely does away with the variation of the pointer which would occur with other constructions.

It is evident that the wide experience of The Moto-Meter Company with internal combustion motors and aeroplane conditions have enabled them to recognize the requirements of the aeroplane at every point, and undoubtedly, their distance type aeroplane instrument will meet with the same enormous success among aviators, as their motor car instrument has among automobilists and racing car drivers.





FOREIGN NEWS

FRANCE

Lieutenant Wilfred MacDonald, of Ossining, has been killed in battle in France, where he was an aviator in the British Royal Flying Corps.

He was twenty-three years old and a nephew of Mrs. Robert T. Irvine, of Ossining, wife of the former prison physician in Sing Sing. He was trained at the Wright Aviation School. He is the second Ossining aviator to meet death flying. Edmond Genet was killed while flying in the French aviation corps behind the British lines, near Ham.

Grand Headquarters of the French Army in France, June 22.—The intensity of the airmen's activities on the French front is indicated in the week's record of the American Lafayette squadron from June 10 to 16. Fifty-four of their aeroplanes patrolled over the German lines and fought nine air battles, of which Adjutant Raoul Lufbery, Edwin Parsons, and Sergeant Robert Soubrian each fought two, and Stephen Bigelow, Sergeant Walter Lowell and Thomas Hewitt each fought one.

Adjutant Lufbery brought down one of his opponents, winning his tenth victory, while two other German machines were severely damaged. Lufbery is mentioned in a late army order as "a marvelous fighting pilot, who is a living example of audacity, coolness and devotion to his squadron."

GERMANY

Amsterdam, July 1.—A semi-official telegram here to-day from Berlin says:

"The German press, referring to the British indignation at the air attacks on the fortress of London, says that if England wishes to spare her civilians she can remove them from the neighborhood of store places of war equipment. Folkstone, Dover, Sheerness, and London are such store places.

"The German people, under the pressure of English starvation and the war, has become a hard race with an iron fist. England has felt that and will experience it again to-morrow. England may lie and deceive or rage and threaten. The hammer is in our hands and it will fall mercilessly and shatter the places where England is forging weapons against us."

Berlin, June 26.—"During aerial encounters," says to-day's official army headquarters report, "Capt. Baron von Richtofen was successful in overcoming, during the past two days, his fifty-fourth, fifty-fifth and fifty-sixth opponents, and Lieut. Allmenroeder yesterday overcame his thirtieth opponent."

GREAT BRITAIN

"It has been with universal satisfaction that the news has been received of the continuous attacks by air and sea on that nest of pirates, Zeezrugge. Of how many tons of high explosive have been dropped on the town and its defences during the last fortnight we have lost count, but it has been a considerable amount, and has undoubtedly given the enemy something to think about," says the British publication *Flight*.

After commenting on the unfortunateness of not having tackled the now practically first rate fortress before it was developed, the article continues:—

"However, tardily enough these considerations of which we speak have been relegated to their proper place in the scheme and Zeebrugge is marked out for constant attack and, if it is militarily possible, destruction. It will be an intensely difficult task and one that would be practically impossible of achievement were it not for the co-operation of aircraft.

"There are limits to the power of naval forces when opposed to well conceived shore fortifications, as we learned to our cost in the Dardanelles. We know that the fortifications in Zeebrugge have been thoroughly well developed in accordance with all the latest theory and practice, of which the Germans are past masters.

"The whole coast bristles with heavy ordnance, naval guns up to 15-inch calibre in large numbers having been installed among the low lying dunes with which this part of the coast abounds. Then what may be called the permanent fortifications of the port itself have been brought to a high state of efficiency, while the approaches have been made as safe from attack as is humanly possible by a very complete system of minefields, with the services of a powerful mosquito fleet to watch and protect them.

"It is, therefore, thanks mainly to our superiority in the air that we are able to seriously entertain the possibility of reducing this formidable fortress to impotence. Without aerial observation gunfire from ships which cannot approach within ten miles in safety would, naturally, be blind and robbed of nine-tenths of its effect. Even supposing that maximum effect of fire could be produced without the services of aircraft, the job would be more difficult and would take infinitely longer were it not possible to discharge many tons of explosives from the air, as our seaplanes have been doing for a month past.

"Truly, if there is one arm that more than another dominates the operations of modern war it is the aerial. No matter what phase or what aspect of war we consider, we find that aircraft in superior numbers provide the ultimate factor, and that is almost as true at sea as it is ashore."

An American Port, July 1.—Because of the enormous casualties sustained by German airmen within the last ten months and the present efficiency and superior number of Allied aviators and airplanes, Germany has not the slightest chance of ever again holding her own in the air. This opinion was expressed to-day by several aviators of the British forces who reached this port by a British steamship.

Among the liner's ninety-six passengers was Lieutenant Arnold Edwards, of the Royal Flying Corps, injured in France and on his way to Sydney, Australia, where his parents live.

He said that the German fliers hesitate to attack an enemy 'plane single-handed, and never attempt to drive a British or French flier away from their lines unless three or more machines of their own fleet are available.

Lieutenant Edwards was badly injured recently in a fall and was sent home on leave. He has had four 'planes disabled by gunfire when over the German lines, and a month ago his machine was so badly crippled by a chance shot that he barely managed to land safely on French soil.

London, June 26.—Three British naval aeroplanes fought a battle with ten German machines over Flanders on Monday. An official account of the fight says one and probably three of the Germans were driven down. All the British airmen returned safely. The announcement follows:

"In the course of a patrol on Monday three naval aeroplanes encountered and engaged ten enemy machines in the vicinity of Roulers. They fought for sixteen minutes and brought down one enemy in flames. It is believed two others were driven down out of control, but clouds interrupted the view. Our machines returned safely."

London, June 22.—"Work in conjunction with our artillery was continued by our aeroplanes yesterday, and in spite of the bad weather good results were obtained," says to-night's British War Office report. "In air fighting one German aeroplane was brought down and six others were driven down out of control. Three of our machines are missing."

The report also tells of the repulse of a German raiding party during the night, in which several of the attacking forces were left dead on the British wire entanglements and a few wounded Germans were captured.

"We made successful raids last night southeast of Queant and in the neighborhood of Neuve Chapelle and Armentieres," says the day report. "Casualties were inflicted on the enemy and we secured prisoners."

The King and Queen of England visiting the Fopwith Aeroplane factory. The photo shows triplanes being assembled

MODEL NEWS

Edited by G. A. Cavanagh

CLUBS

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The Best Length for a Fuselage

(Continued from July 2nd issue)

"The result is obtained by means of *conflicting positive* and *negative surfaces.* Doubtless this reduces speed somewhat, but less, I think, than the dragging tail-plane, and with the advantage of greatly increased steadiness.

"Adopting this principle, I would employ in practice a contractible tail-plane, normally closed, but expanding and lifting when it is desired to soar, or to correct a dive or 'pancake.'

"These broad observations are so far proper to the subject of *fuselage* or rather tail-plane, but they open up questions of wing-formation and speed variation upon which, with your kind consent, I will give the result of my experiments later."

"In view of Lieutenant Dunne's discoveries, a description of some independent experiments and theories which led me years ago to similar discoveries may interest your readers.

"I first noticed, about the year 1886, the surprising 'lift' of an umbrella held nearly parallel with the wind. This suggested 'lifting' wings with dipping front edge now so common.

"Next, finding the lift excessive as my model gained speed, I greatly reduced the dip amidships, and leaving the trailing edge normal throughout, I exaggerated the dip towards the wing tips so as to present a reversed plane which should partially counteract the lift without appreciably checking speed. Such gliders held upside down in the palm and launched as if bowling at the wickets will be found to travel *at high speed horizontally.* In a full-size machine this 'reversed plane' would be increased in pitch or extent with increase of speed, as sometimes seen in birds when gliding downwards against wind.

"My next discovery was the *facility* of steering by means of such wing tips, the minutest variation of pitch producing a marked variation in direction, thus dispensing with rudder or fins. Balanced by this means my glider flew perfectly straight. But the most surprising discovery was its *extreme steadiness and absence of oscillation.* I attributed this to the *rigid 'gripping' of the wing between the two opposing pressures.*

"A tail set at an inappreciable V secured fore-and-aft stability and vertical steering.

"Later I varied the shape, though retaining these principles. All were steady in strong winds, and even quite unpromising shapes when carefully balanced glided admirably.

"My models were shown privately to friends many years ago, more recently (1909) to a director of an aeroplane company, and later to Col. Capper, who exclaimed, 'You have got *our* principle,' and forthwith made a paper model of the 'Dunne' for my enlightenment."

(To be continued)

Master Jerome Sobel Sackheim and His Model Curtiss

During the year 1910 a number of boys, students of Public School 77, Manhattan, found much satisfaction in the construction and flying of model aeroplanes and needless to say, a great many of them are still interested in this fascinating sport. One of the young men, Master Jerome Sobel Sackheim is here shown holding one of his latest Curtiss Military type models. Master Sackheim is only one of the many who became interested in the art of aeronautics while attending school and a number of whom are today enjoying positions of responsibility in the aeronautical industry. There is little doubt but that exeprience gained through the construction and flying of models will prove invaluable to any young man desirous of becoming connected with the aeronautical industry.

Master Sackheim and his Curtiss model

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Uncle Sam

We are fixin' up the factory,
And we're setting up the shop,
For our country needs our flyers,
And our bombs are going to drop;
We will take our flying lessons,
And we'll launch a load of bombs,
So that the crazy Kaiser'll know
When Uncle Sammy comes.

Keep the motors humming,
Aeroplanes are coming,
Turn our pockets inside out,
To buy our bonds.
Uncle Sammy's eagle,
Will make the whole world legal,
Speed the day when Right is Might,
And the whole world's one.

—Augustus Post.

We were unable to confirm the rumor that the Mayor of Chicago has offered the Freedom of that city to the German Kaiser.

Being deprived of our accustomed light beer when flying in "dry" territory, we selected Grape Juice as a substitute; but having had our attention drawn to the effect of that beverage on our windiest politician, we hastily resorted to water.

We hope the politicians, hitherto opposed to aeronautical progress, who are so frantically swallowing their words, don't choke.

The last conversation we had with poor "Tom" Benoist, was in Cicero in 1912 at the scene of a street car accident in which the motorman was killed. Our comment was that it was dangerous for aviators to have to ride in street cars. The tinge of humor has been changed to pathos by "Tom's" sad end.

Try Anything Once!

By some misunderstanding, a now famous film producer, Mr. Selig, understood that one of his actors was an aviator. With the showman's impulse, he had a scenario written, the climax of which was an elopement in an aeroplane. Kathleen Williams was slated for the lead. After several thousand fete of film had been "shot" at great expense, the aeroplane was ready, the actor aviator (?) willing, Miss Williams, about to take her seat, inquired: "How did you become an aviator without my knowing it, Mr. Keen?" "Oh, I haven't been up before, but I'll do the best I can," replied K. K. K. K.

Very Likely

While assisting in separating us from the smashed tractor, a sympathizer got several splinters in his hands which, owing to the excitement, he failed to notice. While the physician was putting stitches in our damaged scalp, the sympathizer helped him hold it. In our semi-conscious state, the voice of the sympathizer vaguely penetrated as he inquired of the doctor, "Does a guy always get splinters in his hands when he helps mend the smashed heads of these aviators?"

A. C. Beech.

To the Editor of that Aerial Age:

(Which dispense with aeronautical information at four dolalrs per yearly.)

Dear Mr. Editor:

With feelings of sorrow in noble heart of Japanese birth I right you these words. Again I am in Hon. Jail. And the reason why? Unfortunate mistake in repelling German aeroplanes, from raids on honorabil Japanese territory.

Having had much experience in aeroplanes from activities thereon in Hon. United States of America, when it appear that German aeroplanes will soon make flights over Hon. Territory of Mikado, Japanese minister of aviationing select me for work of planning destruction on them. With great care I lay plans as follows thusly:—

When German aeroplanes appear over fields of land of rising sun, Japanese aviationers go up in persuing and at same time Japanese guns from land fire great destructions in the directions of upwards. Very nobil plans says hon. minister of aviation flying. "Excellent," I snagger modistly in return for such high compliments.

Very soonly one day many aeroplanes appear over head. I rush from aviation quarter. "Point guns upwardly!" I shout. They do so. "Fire!" I exclaim. It is done. Result. Seven Japanese aviators come down from sky very fast and eight legs and six arms broken veyond recognizing. Seven mashines broke terrible. I am in jail again.

Hoping you are the same

Hashimura Togo.

Dream of raw recruit, on being told that he has made the Aviation Section

EVERYTHING IN RUBBER FOR AIRPLANES

BALLOONS OF ANY SIZE AND EVERY TYPE

The Eyes of the Guns

The Great War has shown clearly that the observing airplane is not all-sufficient for the artillery.

The needs of the guns must often be served by more unwavering eyes.

The stable and readily available kite balloon is an indispensable eye of the guns, and its further development is as imperative as the perfection of any of the other aerial services.

Before the new Goodyear Kite Balloon was tested and approved, the problems demanding better solutions were the primary ones of *material* and *stability*.

In both, Goodyear has made a decided advance.

Our work for many years on balloons of any size and every type has put the former on a standardized basis, which simplifies specification and makes definite the direction of further progress.

The latter demanded newly directed labor in design and ungrudging research in the field—in our own country and abroad.

The result is the new Goodyear Kite Balloon.

Even as years of achievement have justified its Goodyear fabrics, exacting tests have justified its reinforced tail cups and the design of every part.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
AKRON

(*Continued from page* 560)

tion has been attracted to the employment of aircraft over the land than to their employment over the water, I beg leave to state that, in my opinion, a grave mistake is being made, in overlooking the importance of aerial operations against the German fleet and U-boat bases.

"My opinion is based on the following considerations:

"(1) The danger on the sea threatens the Allies more immediately, vitally and intimately than does the danger on the land; because it involves the commerce of the entire world, and threatens soon to stop their supply of actual food and fuel. The danger on the land, great as it is, is not so great as it is on the sea, because it would take a longer time in which to bring about disaster, and because the disaster would be more restricted as to locality and amount.

"(2) Although major operations on both land and sea are now practicable with aircraft. No successes on land, which can reasonably be expected within the next twelve months, would weaken Germany much, whereas a successful attack on her fleet would ruin her.

"Such an attack could be made within the next six months, if adequate energy were employed.

"(3) A torpedo, discharged from a torpedoplane at a ship has the whole length and under-water body of the ship as a target, and is fired under conditions practically identical with the conditions under which it is fired from a destroyer; so that it is fired under the conditions for which it has been developed, and in which naval officers have been trained. This means that if a torpedo is fired at a ship from a given distance, it has a much greater chance of hitting that ship than would a bomb dropped from a height equal to that distance. Conversely, with any given chance of hitting, the torpedo could be discharged from a much greater distance than the height from which a bomb could be dropped.

"I beg leave also to call your attention to the persistent demand of a large section of the British public, headed by Mr. Winston Spencer Churchill, for an attack against the German fleet. Up to the present time, the British Admiralty has not thought that a successful attack could be made by naval vessels. In my opinion, a successful attack could be made, with the assistance of torpedoplanes.

"It is a matter of common knowledge that the oil supply of the British fleet is so seriously threatened that the use of her newest and best vessels which burn oil exclusively, may soon become impossible. Before the shortage of oil becomes so great as actually to cripple the fleet, would it not be wise to venture an attack, backed up by an overwhelming force of torpedoplanes, which contribute that freedom from danger from mines and submarines, which is the only element of success that is lacking now? In my judgment, this demands serious and prompt consideration.

"I respectfully request that you bring this urgent question to the attention of the proper persons.

"(Signed) B. A. FISKE,
"Rear Admiral, U. S. Navy, Retired."

The Executive Committee resolved to make known the facts contained in Admiral Fiske's letter to the Council of National Defense, the Aircraft Production Board, the Chairman of the Committee on Military and Naval Affairs of the Senate and House of Representatives and the general public through the press.

Aviation and Publicity

(Editorial in Phil. Pub. Ledger)

THE resolve of the army chiefs, including Secretary Baker, that an initial appropriation of $600,000,000 for the aviation service is to be urged on Congress is the result of the intelligent and continuous publicity of those interested in this vital branch of the service. It is hardly necessary to recall that just one year ago there were none so poor as to do the service justice, while the pitiable showing on the Mexican border was made all the more disgraceful by the scandals within the service itself, the full facts as to which were never fully grasped by the public. Then followed a long series of explanations with very little doing until outside pressure, coming from various officials of the aeronautic societies, began to have an effect in the great campaign for an adequate supply of aeroplanes. But even they and Admiral Peary had not the effect they ought to have had, and it was not until the actual brunt of war exposed the folly of the long delay that every one woke up. Now those responsible for the delay are all saying just what the publicity of outsiders has forced them to say, with the honorable exception of Brigadier General George O. Squier, called in a year ago to clean up the mess that the aviation corps had got itself into. But that is all of the past; now to the future, and no fooling with an arm of the service that may bring about a decision of the war.

"At the Mexican Border, I found an aviator worth a Cavalry Division." —General Pershing.

"An aviator is worth an Army Corps."—General Kitchener.

In September, the Government will select young men for different branches of the Service. Those who have had aeronautical training will be assigned to the Aviation Section, which is the preferred arm of the Service.

To any man physically fit, between the ages of 19 and 30, the Gallaudet Aviation School offers a splendid opportunity.

The School, located on beautiful Narraganset Bay, is *the* ideal hydro field and offers both land and water flying. The students at this school have the advantage of familiarizing themselves with construction work by visiting the Gallaudet factory in the immediate vicinity.

The course covers two months of intensive training under military regulations. The tuition is $600, giving the pupil 600 flying minutes.

INSTRUCTORS:

Phillips D. Rader, who has seen active service at the front.
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Announcement

Knabenshue Aircraft Corporation

DIRIGIBLE CONSTRUCTORS

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NEW YORK CITY

A. ROY KNABENSHUE
GENERAL MANAGER

THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

WRIGHT-MARTIN AIRCRAFT CORPORATION
60 Broadway -:- New York

(*Continued from page* 571)

Influences on the Aircraft Constructor of the Particular Employment

Thus there are strict limits to the size of radial engines, whether of the rotary or of the stationary type, which it is profitable to employ for aircraft work; while in regard to the vertical, or to the V-shaped engines, the nature of the particular service to which each individual engine is to be put likewise imposes certain limits.

In certain cases strict limits must be set to overall length of the engine, particularly at a time of war in the air, when, at need, it is essential to lose the minimum time in altering the flight path of a machine from a diving attitude to a very steep climbing one. Again, some sorts of aircraft call for the minimum engine head resistance, but the less imperative to overall length; hence the six-cylinder type would be suitable for such service, whereas the V-shaped variety would not be.

Uniformity of Certain Characteristics

In other words, at this period it is impossible to lay down any arbitrary rules as to any one type of aircraft engine being suitable for the needs of all aircraft service. Those needs are almost as various as are the demands for special varieties of steel and of alloys. Moreover, they are likely to multiply with the lapse of time. Yet between the widest varieties we perceive the essential characteristics of demand to be uniform. This is a great gain alike to the designer and to the manufacturer on the one hand and to the Services on the other.

It means that when the right scheme of design is evolved, the least possible disturbance is caused in the given factory, though it be concerned with producing power plant of various size, weight, and horsepower output. Therefore the maximum production can be attained, while the problems of management and repair are correspondingly reduced to the minimum. Interchangeability can be exploited to the maximum, and once the mechanics and pilots have mastered the principles of whatever system of construction is in question, it is found that those principles are applicable to all varieties of the given system of construction.

Demand in a State of Flux

When we come to systems of construction, again there can be no laying down of hard-and-fast rules, for the sufficient reason that the suitability or otherwise of systems are predetermined by the demands of the aircraft constructor and the aircraft user, which demands are ever varying. Therefore what system may be the most suitable thing possible to attain in satisfaction of the demand of to-day is not necessarily the principle on which to work for satisfying the demand of next year or of five years hence.

Hence, while we may make bold to criticize the suitability of this system or that to satisfy the insistent demand of the hour we must have a care not to be drawn into the making of sweeping assertions about the practicability of any system of construction for the necessary nebulous needs of the future.

Difference Between Might Be and Must

Probably it is little realized that if the aircraft engine designer had not to think of the means at present available to the manufacturer, nor of the time factor, nor of those to whose tender mercies the standardized product will be submitted, he would produce very different designs to fulfill any given purpose from those he evolves today.

Aircraft engine design resembles motor-car engine production in this particular, that it is all the time a question of compromise. The most successful designer is he who exercises the soundest judgment in weighing a hundred and one factors of the hour and who gives the shrewdest estimate of the relative value of each.

The News of the Hour

Having thus striven to give a notion of what one might style the psychology of aircraft engine designing at this or any period, let us take some of the governing factors of today somewhat more in detail. It is not deemed desirable, therefore it is not proposed, to give in a paper of this sort particulars of any engines such as are being, or are about to be, used by the Services in this war. Instead, it is held to be preferable to review with more or less detail the points that have received most attention in the development of the design of the latter-day aircraft engine.

The Three Main Springs

In regard to the general arrangement of aircraft engines, there are several main types, each of which involves advantages as well as disadvantages. The business of the designer is to effect the best compromise possible to fulfill the particular class of service that is had in mind in scheming the individual engine.

Of course, multi-cylinders are common to all types of aircraft engines. But the arrangement of the cylinder groupings and settings differs entirely as between one type and another. Doubtless, the most generally favored form is the V-type with either 12 or 8 cylinders per unit, these being set in two rows on a common crankcase whereby one crankshaft suffices because one crankpin serves for each pair of opposed cylinders.

Undoubtedly next in order of importance is the radial type, in which the cylinders are set in one or more planes with axes radiating from the center line of the crankshaft.

The two sub-divisions of the radial type of engine are the rotating and the fixed variety.

What we may style the straight-line engine constitutes the third main type of engine. In this four, more generally six, and in a few examples, even eight cylinders, and 12, are placed in a line and are set vertically on a crankcase, the pistons and connecting rods acting on a crankshaft with one crankpin per cylinder in the orthodox fashion of motor-car engine practice.

(*Continued from page* 565)

hydrogen. Ferro-silicon at 15 cents per pound and caustic soda at 3 cents per pound would bring the total cost for materials to $12.46 per 1,000 cu. ft.

Ferro-silicon may be stored without deterioration by moisture and without any special precaution for its care. The caustic soda must be protected from moisture and is usually supplied in air-tight drums containing 100 pounds.

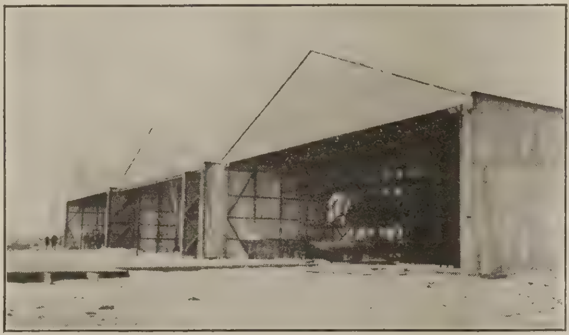
In connection with silicol generators, there are required washers and purifiers to remove from the gas the hot vapors carrying caustic soda solution. Field generators of this process should always be set up for operation near a stream or other ample supply of water. It is possible to design the generating equipment with radiators for cooling the circulating water for situations where water economy is important.

(*Continued from page* 568)

netos to plugs are run in two separate metal conduits, thus preventing trouble from induced currents.

Magneto Advance—Magneto breaker boxes are interconnected in such a way that a single rod from the cockpit advances an dretards both magnetos simultaneously. Adjustment is provided to permit synchronous timing of two magnetos.

Carburetor Safety Device—That part of air not taken from crankcase comes from one of the outer compartments of crankcase double wall. Drains are provided to prevent accumulation of fuel.



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The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

The Buck Aircraft & Munition Co., Inc.
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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed without in any way affecting the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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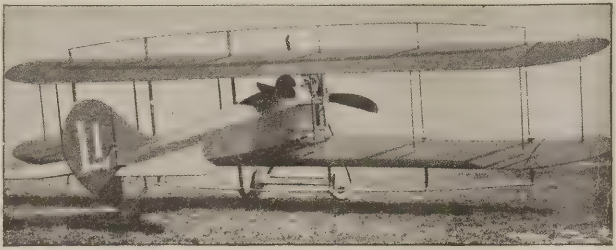

With the manufacturing facilities of factories in New York, Tennessee and New Jersey, we are in a position to execute, with dispatch, orders for the Lanzius Changeable Angle of Incidence Airplane, in any type for land or sea, or for Standard and Special Designed Aircraft, either wood or steel construction.

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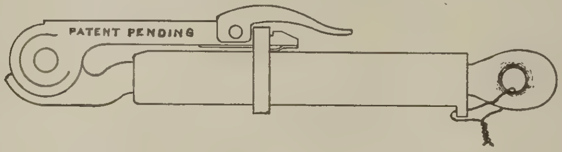
The purpose of this turnbuckle is to pull together and tighten or loosen, as may be desired, a metallic cord or cable. This is obtained by turning the sleeve in one direction or the other to suit the required purpose.



The advantage of this turnbuckle over all other types is that it can be attached and detached without changing the screw adjustment of the turnbuckle. It can easily be attached or detached, at the same time eliminating the necessity of readjustment.

The *Bellanca Turnbuckle* is manufactured to meet the recognized requirements of strength, weight and durability.

From the description above given, the advantages of the *Bellanca Turnbuckle* over all other types will readily be seen and appreciated.

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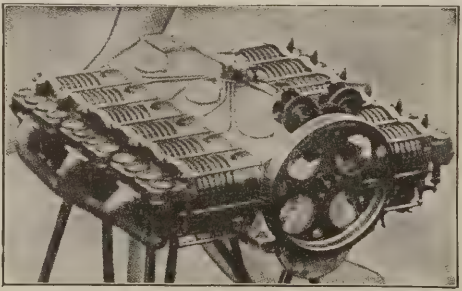

¾ top view of ASHMUSEN 12-Cylinder 105 H.P. Self Cooled Aeronautic Motor

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Bore 3¾ in.—Stroke 4½ in.—Four stroke cycle.
Ignition—High Tension Magneto.
Carburetor—Improved ASHMUSEN.
Oiling—Forced Feed ASHMUSEN System.
Cooling System—NONE—Self Cooled.
Weight—70 H.P.—240 Lbs.; 105 H.P.—360 Lbs.
Fuel Consumption—70 H.P.—7½ Gals. per hour, Low Grade.
Fuel Consumption—105 H.P.—11⅓ Gals. per hour, Low Grade.
Oil Consumption—70 H.P.—¾ Gal. per hour, Good Grade.
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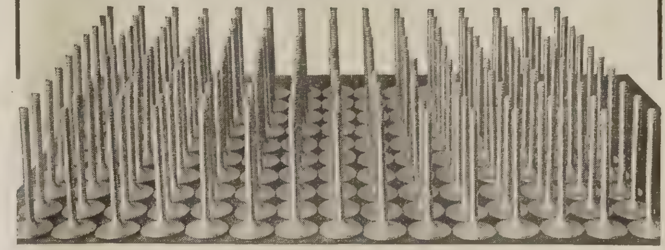

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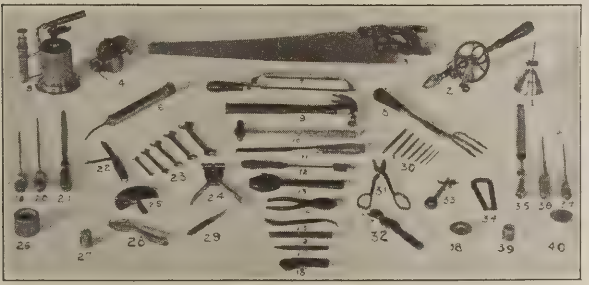

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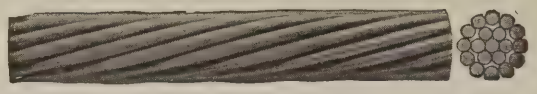

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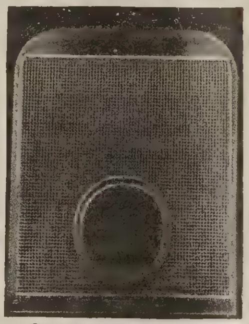

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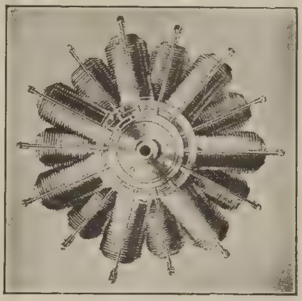

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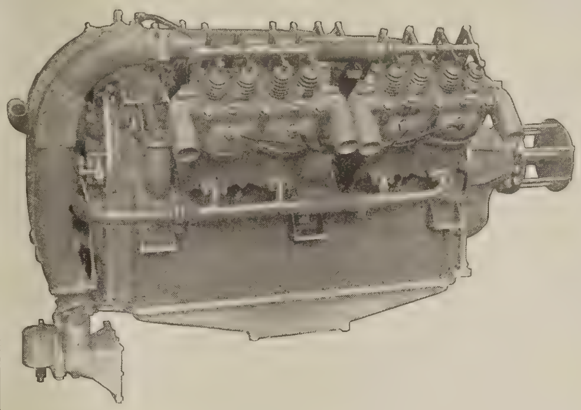

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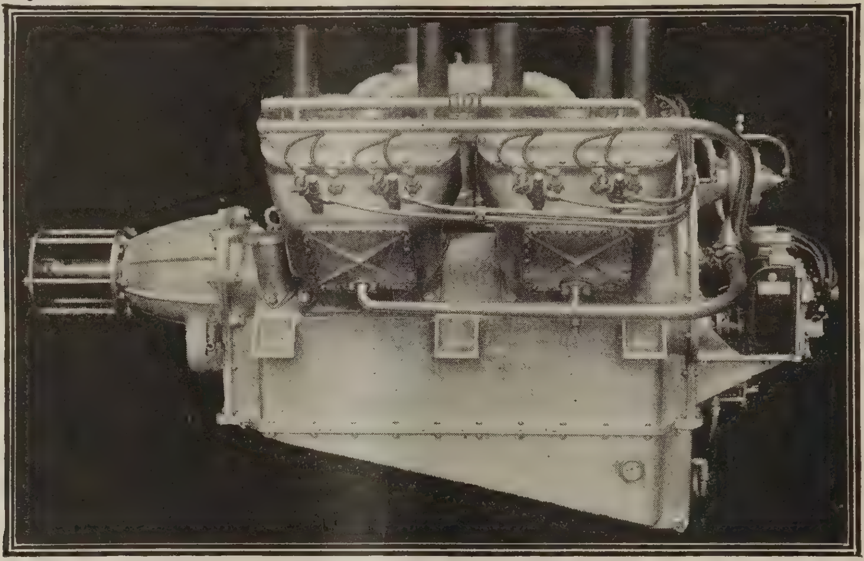

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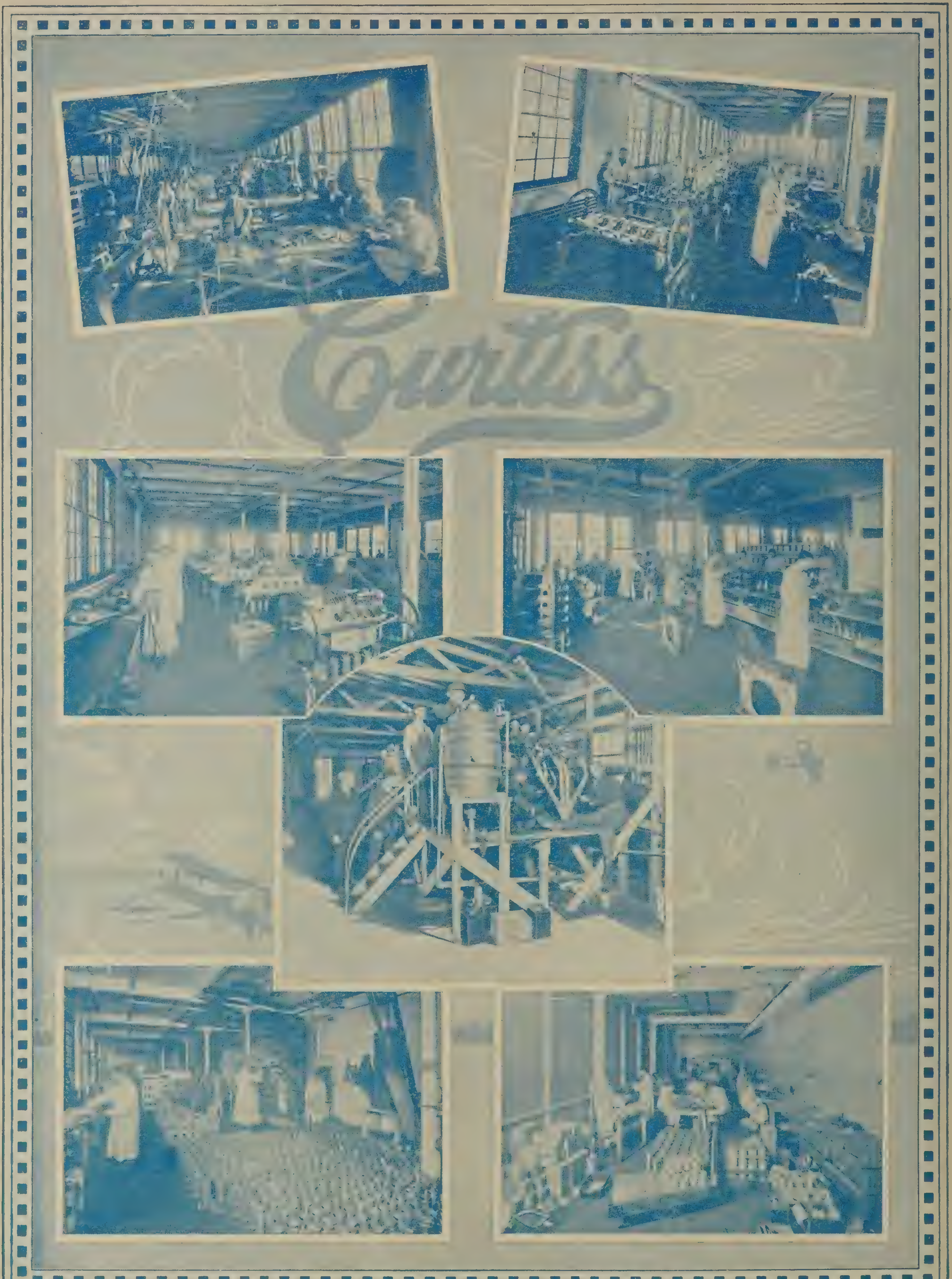

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WEEKLY

Vol. 5, No. 18 JULY 16, 1917 10 CENTS A COPY

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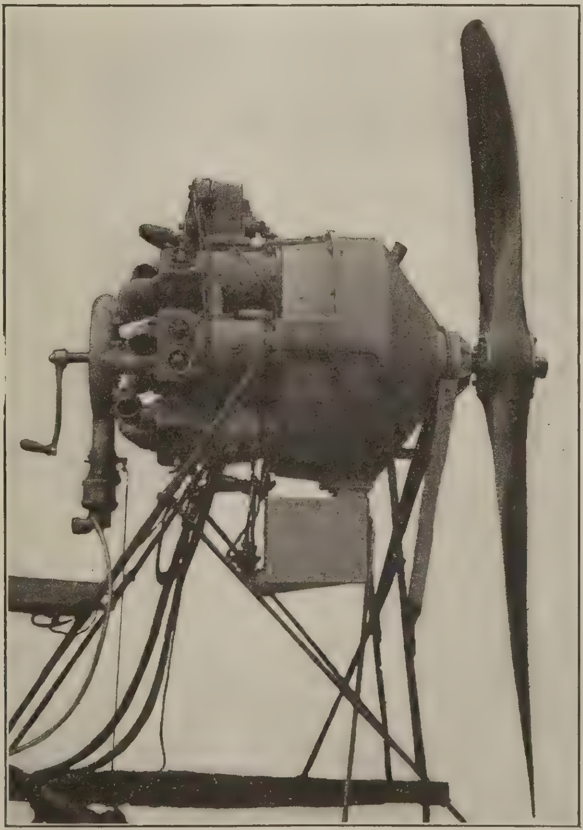

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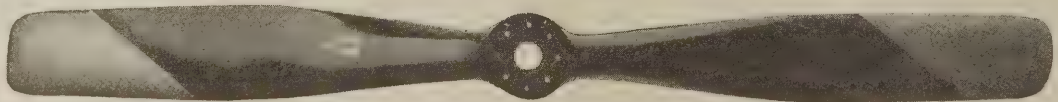

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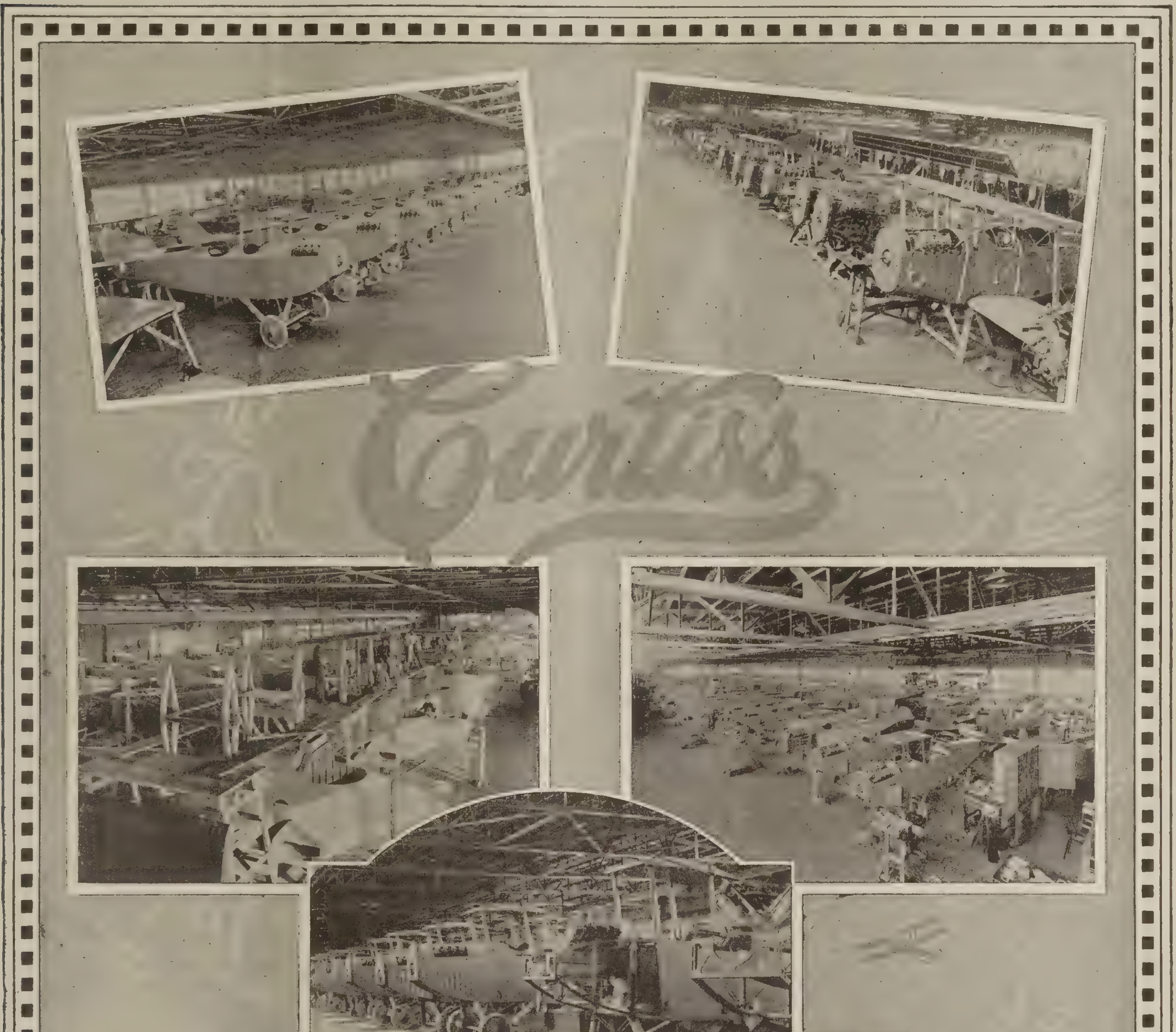

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VOL. V NEW YORK, JULY 16, 1917 No. 18

AERONAUTIC APPROPRIATION AND PERSONNEL BILLS INTRODUCED IN CONGRESS

THE aeronautic appropriation and personnel bills have been introduced in Congress. Secretary Baker sent the Appropriation Bill to Chairman Dent of the House Committee on Military Affairs on July 4. Altogether the bills propose an appropriation of $639,000,000. The legislation calls for 22,625 aeroplanes and full equipment of machine guns, bombs, etc., and 100,000 aviators to man them. It is estimated that the aeroplanes will cost $363,140,000. Among the items specified are balloon squadrons, $27,710,550; training squadrons, $16,750,000; service squadrons, $66,500,000; supply squadrons, $13,440,000; training stations, $31,000,000; machine guns, $24,000,000. The men are to be obtained by voluntary enlistment or by draft, according to the recommendations of the War Department.

The Personnel Bill, which was introduced by Chairman Huber S. Dent, Jr., of the Committee on Military Affairs of the House, is as follows:

A BILL to authorize the President to increase temporarily the Signal Corps of the Army and to purchase, manufacture, maintain, repair, and operate airships, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in view of the existing emergency, which demands the raising of troops in addition to those now available, the President be, and is hereby, authorized to increase temporarily the present authorized commissioned and enlisted strength of the Signal Corps of the Army, including the Aviation Section thereof.

SEC. 2. That to provide temporarily the additional commissioned personnel required by this Act the President is authorized to promote, appoint, detail, or attach as temporary officers in the Signal Corps, including the Aviation Section thereof, officers of the Regular Army, National Army, or National Guard, or the Officers' Reserve Corps, or to temporarily appoint enlisted men of the Regular Army, enlisted men of the Enlisted Reserve Corps, or persons from civil life: *Provided,* That no person shall be so promoted, appointed, detailed, or attached until he shall have been found physically, mentally, and morally qualified under regulations prescribed by the Secretary of War: *Provided further,* That officers with rank not above colonel shall be appointed and commissioned by the President alone, irrespective of the rank or grade held by them on the date of the passage of this Act, and that officers above the grade of colonel shall be appointed by the President, by and with the advice and consent of the Senate, irrespective of the rank or grade held by them on the date of the passage of this Act.

SEC. 3. That to provide the additional enlisted men required by this Act, the President is authorized to raise and maintain, by voluntary enlistment or by draft, such number of enlisted men as he may deem necessary and to embody them into organizations hereinafter provided for in section four.

SEC. 4. That the President is hereby authorized to appropriately officer and organize the personnel of the Signal Corps into such number of divisions, brigades, regiments, wings, squadrons, battalions, companies, and flights as may be necessary, and to increase or decrease the number of organizations prescribed for the divisions, brigades, regiments, wings, squadrons, battalions, companies, and flights, and to prescribe such new and different organizations and personnel for divisions, brigades, regiments, wings, squadrons, battalions, companies, and flights as the efficiency of the service may require.

The President is further authorized to organize such headquarters and headquarters detachments for divisions, brigades, regiments, wings, squadrons, battalions, companies and flights as may be necessary, and to prescribe new and different organizations for such headquarters and headquarters detachments whenever the efficiency of the service may require.

SEC. 5. That the President, by and with the advice and consent of the Senate, is authorized to appoint for the period of the existing emergency such general officers of appropriate grades as may be necessary for staff duty and for duty with such brigades and divisions of the troops of the Signal Corps, including the Aviation Section thereof, as may be organized by the President.

Vacancies in all grades of the Regular Army, National Army, or National Guard resulting from the temporary appointment of officers thereof to higher grades shall be filled or vacated as provided for in sections eight and nine of the Act authorizing the President to increase temporarily the military establishment of the United States and approved May eighteen, nineteen hundred and seventeen.

SEC. 6. That officers detailed in or attached to the aviation section of the Signal Corps may, when qualified therefor, be rated as junior military aviators, military aviators, junior military aeronauts, and military aeronauts, but no person shall be so rated until there shall have been issued to him a certificate to the effect that he is qualified for the rating, and no certificate shall be issued to any person until an examining board, which shall be composed of two officers of experience of the aviation section of the Signal Corps and one medical officer, shall have examined him under general regulations to be prescribed by the Secretary of War and published to the Army by the War Department, and shall have reported him to be qualified for the rating. No person shall receive the rating of military aviator or military aeronaut until he shall have served creditably for three years as an aviation officer with the rating of a junior military aviator or the rating of a junior military aeronaut, except that in time of war any officer who specially distinguishes himself in active service may, upon recommendation of the Chief Signal Officer of the Army, be rated as a junior military aviator, military avitar, junior military aeronaut, or military aeronaut without regard to examination or to length of service as an aviation officer or aeronautical officer; *Provided,* That junior military aeronauts and military aeronauts shall be entitled to the same increase in rank and pay as are now authorized by law for junior military aviators: *Provided further,* That any officer attached to the aviation section of the Signal Corps for any military duty requiring him to make regular and frequent flights shall receive an increase of twenty-five per centum of the pay of his grade and length of service under his commission.

SEC. 7. That the Secretary of War is authorized from time to time to cause such number of the enlisted men of the aviation section of the Signal Corps above the grade of corporal as he may deem necessary to be rated as aviation mechanicians or as balloon mechanicians in the manner now prescribed by law: *Provided,* That balloon mechanicians shall receive the same increase of pay as now prescribed by law for aviation mechanics.

SEC. 8. That all officers and enlisted men of the temporary forces of the Signal Corps, including the aviation section thereof provided for herein, shall be in all respects on the same footing as to pay, allowances, and pensions as permanent officers and enlisted men of corresponding grades and length of service in the Regular Army.

Provided, That nothing in this Act shall operate to decrease the present authorized strength of the Regular Army or National Army heretofore authorized by law.

SEC. 9. That authority is hereby given to the President, through the War Department, for the purchase, manufacture, maintenance, repair, and operation of airships and other aerial machines, including instruments and appliances of every sort and description necessary for the operation, construction, or equipment of all types of aircraft, including guns, armament, ammunition, and all necessary spare parts and equipment connected therewith; and all necessary buildings for equipment and personnel in the Aviation Section, and for the exclusive purchase, maintenance, repair, and operation of motor propelled passenger and equipment carrying vehicles which may be necessary for the Aviation Section.

And authority is hereby further given for the establishment, equipment, maintenance, and operation of aviation stations, including (a) the acquisition of land, or any interest, in land with any buildings and improvements thereon, by purchase, lease, donation, condemnation, or otherwise; (b) the improvement of such land by clearing, grading, draining, seeding, and otherwise making the same suitable for the purpose intended; (c) the construction, maintenance, and repair of permanent or temporary barracks, quarters, hospitals, mess houses, administration, instructional and recreational buildings, hangars, magazines, storehouses, sheds, shops, garages, boathouses, docks, wireless stations, laboratories, observation stations, and all other buildings and structures necessary or advisable; (d) procuring and introducing water, electric light and power, telephones, telegraph, and sewerage to aviation stations and buildings and structures thereon by the extension of existing systems or the creation of new systems and their maintenance, operation and repair, installation of plumbing, electric fixtures and telephones, fire apparatus and fire alarm systems and the maintenance, operation and repair of all such systems, fixtures and apparatus; (e) construction and repair of roads, walks, sea walls, breakwaters, bridges and wharves, dredging, filling and otherwise improving land and water sites; (f) purchase of stoves and other cooking and heating apparatus, kitchen and tableware, and furniture and equipment for kitchens, mess halls, offices, quarters, barracks, hospitals, and other buildings, screens, lockers, refrigerators, and all other necessary equipment; (g) purchase of gasoline, oil, fuels, and all supplies of every kind and character necessary or advisable for maintenance and operation of aviation stations, including electric light and power, telephones, water supply and sewerage service; (h) purchase and manufacture and installation of all kinds of machinery, tools, material, supplies, and equipment for construction, maintenance, and repair of aircraft, buildings, and improvements at aviation stations, or property or appliances used in connection with aviation.

And also for the purchase or manufacture and issue of special clothing, wearing apparel, and similar equipment for aviation purposes.

And also for the actual and necessary expenses of officers, enlisted men, and civilian employees of the Army and authorized agents sent on special duty at home and abroad for aviation purposes, including observation and investigation of foreign military operations and organizations, manufacture of aircraft, and engines, also special courses in foreign aviation schools and manufacturing establishments, to be paid upon certificates of the Secretary of War certifying that the expenditures were necessary for military purposes.

And also for vocational training, including employment of necessary civilian instructors in important trades related to aviation, purchase of tools, equipment, materials, and machines required for such training, purchase of text books, books of references, scientific and professional papers, periodicals and magazines, and instruments and material for theoretical and practical instruction at aviation schools and stations, and all other means to carry out the provisions of section twenty-seven of the Act approved June third, nineteen hundred and sixteen, authorizing, in addition to the military training of soldiers while in active service, means for securing educational and vocational training of a character to increase their military efficiency and enable them to return to civil life better equipped for industrial, commercial, and general business occupations.

And also paying and otherwise providing for such officers of the Officers' Reserve Corps of the Aviation Section of the Signal Corps and such enlisted men of the Enlisted Reserve Corps of the Aviation Section of the Signal Corps as may be called into active service and such enlisted men as may be enlisted in the Aviation Section of the Signal Corps under the provisions of section two of the Act to increase temporarily the military establishment of the United States, approved May eighteen, nineteen hundred and seventeen, or any subsequent Act temporarily increasing the commissioned or enlisted personnel of the Aviation Section of the Signal Corps and such civilian employees as may be necessary, for the payment of their traveling and other necessary expenses when not traveling with troops, and for the necesary expense of the Aircraft Production Board; *Provided,* That hereafter all reserve officers and enlisted men of the Aviation Section of the Signal Corps shall be paid by Quartermaster Corps disbursing officers from funds transferred to their credit from Signal Corps appropriations.

And also for the payment of all expenses in connection with the development of suitable types of aviation engines, aeroplanes, and other aircraft appurtenances, including the cost of sample engines, airplanes and appurtenances, cost of any patents and other rights therein, and costs of investigation, experimentation, and research in respect thereto.

And also for the payment of all expenses in connection with the creation, expansion, acquisition, and development of plants, factories, and establishments for the manufacture of airplanes, aircraft, engines and appurtenances, including provision for the purchase or lease of land with the buildings thereon, construction of permanent or temporary buildings for all purposes, purchase of machinery, tools, and employment of operatives, together with all administrative expenses necessary, the purchase and supply of raw and semifinished materials and of fuel and all other things necessary for creating and extending the production of airplanes, aircraft, engines, and all appurtenances.

And also for creating, maintaining, and operating at technical schools and colleges courses of instruction for aviation students, including cost of instruction, equipment, and supplies necessary for instruction and subsistence of students while receiving such instruction.

And also for organization, administrative and contingent expenses in the District of Columbia and elsewhere, including chief clerks, and seven principal clerks, chiefs of divisions, and such other services as the Secretary of War may deem necessary, office rents, office furniture and equipment, stationery, plans, drawings, photographs, photograph materials and equipment, and all other necessary office supplies and expenses.

Provided, That motor-propelled vehicles, aeroplanes, engines, parts thereof, and appurtenances may be exchanged in part payment for new equipment of the same or similar character to be used for the same purpose as those proposed to be exchanged.

Provided further, That during the present emergency, officers and enlisted men of foreign armies attached to the Aviation Section of the Signal Corps as instructors or inspectors when traveling on official business pertaining to the Aviation Section of the Signal Corps shall be authorized, from funds appropriated in this Act, the same mileage and transportation allowances as are authorized for officers or enlisted men of the Regular Army.

Aero Club Points Out that Aeronautic Appropriation Provides Only Quarter of the Number of Aeroplanes and Aviators Needed

Declaring that the way for the United States to win the war is in the air, Alan R. Hawley, president of the Aero Club, made public a letter to President Wilson, urging that the government's appropriation for aeronautics be increased to $2,000,000,000.

Mr. Hawley states that the government would lose the advantage of manufacturing facilities already offered, if it did not place contracts for the manufacture of aeroplanes in large numbers at once. The letter read:

"The seriousness of the situation, emphasized by the extensive German air raids on Great Britain and the continuous sinking of ships by U-boats, make it our duty to bring to your attention the following facts:

"The proposed aerial programme only aims to provide 22,500 aeroplanes, and that is not sufficient to train and equip the 10,000 aviators needed for major aerial operations on the western front, since it will take an average of one aeroplane to train one aviator and three aeroplanes to equip each aviator, making a total of 40,000 aeroplanes that should be provided for major aerial operations on land.

"Whereas decisive victory against Germany can only be achieved through major aerial operations against the German fleet and U-boat bases, to be conducted at the same time as major aerial operations are conducted against the German military centres, military bases and railroads on land, steps should be taken immediately also to provide for training and equipping the 10,000 naval aviators needed for

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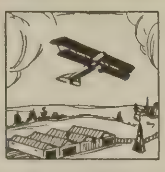


THE NEWS OF THE WEEK

Aircraft Exhibit for Washington

The National Advisory Committee for Aeronautics and the aircraft production board have instituted a project for a permanent exhibit of aircraft materials of all kinds, including engine parts and sections of planes, to be established in Washington for the benefit of Army and Navy engineers and American manufacturers. A building to house the exhibit is now being constructed by the Government south of the Smithsonian Institute, and the display will be made available to all aircraft manufacturers and kept up to date as the science develops. It is expected to be of very material assistance to the new aircraft building project in that it will enable American manufacturers to become familiar with the latest developments in the art.

The latest foreign machines and specialized parts from foreign makers, reflecting the highest development of European building science after the three years of war, will be displayed. The exhibit promises to be of particular value in the near future in enabling Government engineers and private manufacturers to study the designs and details of construction with a view to learning to what particular branch of the industry manufacturing plants can best be adapted in the creation of the new American air fleet.

"The aircraft production board has no illusions as to the size and character of the job before it," a statement issued by the board to-day says, "but the whole task is one of industrial organization for quantity production, and in this we Americans are above all other nations fitted by experience and tradition to break records. The new permanent aircraft exhibit should furnish a valuable aid to the process of familiarizing the industry with the task and organizing for its accomplishment."

To Build Aeronautic Laboratory

The National Advisory Committee for Aeronautics has issued the following:

The National Advisory Committee for Aeronautics has just closed a contract with the J. G. White Engineering Corporation for the erection of a research laboratory on Langley Field, near Hampton, Va.

At this laboratory, in addition to the usual structural tests on aeroplanes and aeroplane parts, scientific research peculiar to aeronautics will be conducted under the immediate supervision of the committee.

Instruments are now being designed for use on aeroplanes to measure the various quantities which enter into the performance of a plane when in free flight. In particular these measurements will include the thrust developed by the propeller, the power absorbed and the revolutions, also the various movements made by the control levers and the resulting motions of the plane, including rolling, yawing, pitching, and likewise the attitude of the plane as a whole in relation to the horizontal.

A wind tunnel of the Eiffel type will be erected for model tests on aeroplanes, surfaces, and propellers. Having the results of tests on models and full-sized surfaces, it will be possible to more accurately determine the laws by means of which results from model tests may be applied to full-sized machines and surfaces.

The laboratory will comprise complete machine, instrument, and pattern shops, as well as a drafting room with the most modern equipment.

Build New Curtiss Plant

Atlantic City, N. J.—The Curtiss Aeroplane and Motor Boat Company of Buffalo is erecting a plant here for the construction of areoplanes, which will be in operation within six weeks. A school for the training of young men for military service will be held in conjunction with the factory.

This station will be run with the three other plants owned by the company in the fulfillment of Government contracts.

Norma's New Booklet

The Norma Company of America, 1790 Broadway, New York, in consideration of the Washington Convention of the Society of Automotive Engineers, issued a special folder under the title "Norma—In the National Service." In very brief paragraphs it refers to the almost universal standardization of magnetos and lighting generators on "Norma" ball bearings in the fields covered by the combined societies—automobiles, trucks and motorcycles; motor boats; aeroplanes; gas engines and tractors. Without specific reference in the text to war time conditions, a martial atmosphere is given the folder by the character of the pen-and-ink illustrations.

Wind Tunnel for California

Pasadena, Cal.—The preliminary steps for the study of aeronautics at Throop College of Technology have been taken, and the contract has been let for the construction of the projected wind tunnel in which aeroplanes will be tested.

Dr. H. Bateman of Johns Hopkins University has arrived to carry on this work, which will be done under supervision of the War Department.

Opera to Aid War Aviators

Announcement that the proceeds of the series of grand opera performances to be given at Columbia University this month will go to the aviation fund of the National Special Aid Society, was made last week from the offices of the society. The performances are to be on the evenings of July 17, 19, 21, 24, 26, 28, 30, and 31, and will be directed by Edoardo Petri, of the Chorus School of the Metropolitan Opera Company.

Aviation Fields for Landing Needed

Washington.—Glenn S. Curtiss, of the Curtiss Aeroplane Company of Buffalo, N. Y., has taken the initiative in urging the Federal Government to inaugurate a movement for the establishment of aviation landing fields throughout the country and the charting of these flying fields on the official maps of the Government, so as to enable airmen to travel by map along the air lanes when thus established. In a letter to Colonel W. W. Hart, United States Army, Superintendent of Public Buildings and Grounds in Washington, which was prompted by the experiences of Miss Katherine Stinson in her recent successful flight from Buffalo to Washington for the American Red Cross, he says in part:

"To one who has not given the matter much thought it would seem a very easy matter to find in or around cities a good level field 500 to 1,000 feet wide and 3,000 to 5,000 feet long, not obstructed by fences, trees, wires, or smokestacks. Yet such a field is a very difficult thing to find, and it was only after continued search that we were able to secure in such towns as Rochester, Syracuse, Albany, and Philadelphia fields that were at all suitable for Miss Stinson's landing.

"In Albany she tells me that she was compelled to land in a wheat field on one of the islands in the river. In Philadelphia the only suitable spot proved to be in a small hollow surrounded by trees, a spot very difficult to get into and dangerous to get out of."

Mr. Curtiss makes the following suggestions:

"(1) To make provision for having the Polo Grounds at Potomac Park designated as the first official Aviation Field No. 1, and marking it with white limestone letters at least 100 feet high or by a white vegetable growth which would answer the same purpose.

"(2) Interest the Geological Survey in the subject and secure its co-operation in the making of maps bearing proper designations for each city. The official aerial map would show a landing field at Washington, D. C., as the Polo Grounds at Potomac Park, giving as its distinguishing mark 'A-1.' As fast as flying fields were finished in other cities the plan is to give them a number also, which can be registered and with which War Department and cross-country aviators would become familiar. This list could be handled in much the same way as maritime marks are tabulated in the lighthouses and buoy lists furnished to navigators.

"(3) Interest the State, War, and Navy Departments, so that as soon as any city had completed its landing field it could be officially recognized and registered. Under such a plan I believe we could very soon interest all the Chambers of Commerce of all the cities of any size in the entire United States and by asking their co-operation could before next fall have flying fields established in all parts of the country as well as in Canada."

A New Type of Hangar

The large item in the cost of constructing hangars today are the trusses. This is on account of the wide spans required.

The Ashley Steel Building Co., Inc., of New York City, have developed a hangar which has only one truss. This one truss is placed across the front of the building and not only carries the roof load but also the accordion doors. The main part of the building which covers the wings of the machine is about 20 feet deep and the back is built up solid with the exception of 16 feet at the center where an opening is left and another small building added to cover the tail. The roof of the main building is pitched two ways, it is gabled on the front and pitched down to the back. This form of construction is very strong and a perfect wind-brace from all angles, and can be built of a structural steel frace or a wooden frame and covered either with sheet metal or wood sheathing and at a cost materially less than any other type.

The Ashley Steel Building Co. also manufactures portable and permanent all steel and wood buildings of any size for factories and warehouses.

Major Bolling in France

Paris, Thursday, July 5.—Major Raynal C. Bolling arrived in Paris to-day on a special mission for the American War Department. Major Bolling was sent abroad to study aircraft production and uses, as one of the members of an aircraft commission. Before going to France he spent some time in England.

Until recently Major Bolling, with the grade of captain, was the commanding officer of the First Aero Company, Signal Corps, New York National Guard. The company was disbanded and Captain Bolling entered the regular army, where he won promotion in rank.

The Aeromarine training tractor, with Pilot Adams, and Lieut. Coyle as official observer, starting on altitude test

A Hundred Thousand Miles Without Accident

Curtiss instructors at the Atlantic Coast Aeronautical Station have flown Army Reserve Corps men during the last few months a total of 104,000 miles without any serious accident to the corps. Considering the nature of the work, and the distance traveled, this is a remarkable record, and goes far to demonstrate the comparative safety of flying.

British Aerial Expert Coming

The National Advisory Committee for Aeronautics makes the following announcement:

Arrangements have been made for Mr. George Thomson, son of Sir J. J. Thomson, of Cambridge, England, to visit the United States as a representative of the British air board. His visit will have a special significance in reference to the development of designs of apparatus and instruments for scientific research and experimental work in connection with aeronautics, both for the National Advisory Committee for Aeronautics and the War and Navy Departments. It is expected that he will bring to the United States the latest designs and specifications for aeronautic instruments and apparatus and full information in reference to the methods of scientific research developed in England in recent years.

Personal Paragraphs

More than ten thousand people saw Miss Ruth Law compete with Miss Elfrida Mais, the famous automobile racing driver, at the St. Paul, Minn., race track last week.

Wealthy Men in Balloon School at Fort Omaha

Three multimillionaires in their own right and a dozen or more sons of millionaires are among the 600 officers and men who are being whipped into shape for foreign service at the Fort Omaha balloon school.

Yale, Harvard, Columbia and other famous universities are well represented in the ranks of men, who in addition to studying ballooning, rake the lawns, peel "spuds," shovel coal, drill and do guard duty.

Captain Max Fleischman, one of the officers, is head of the Fleischman mine, oil, railroad, land and banking interests. He is many times a millionaire, but his fame has been made as a sportsman, aeronaut and explorer. He is internationally known as a big game hunter.

Lieutenant C. J. Glidden, famous as an automobile enthusiast and head of the Glidden tours, also is on the job at the fort.

Lieutenant E. A. Bryan, possessor of several fortunes, is a student. These three men, with Pilot Leo Stevens, are members of the Aero Club of America.

Tells Flyers of Meterology

Boston.—Dr. Frank Waldo, of Cambridge, has volunteered a series of eighteen lectures on meteorology to the men at the Naval Air Station at Squantum. Meteorology is one of the important matters about which aviators should be informed. Dr. Waldo formerly was a professor in the United States Signal Service at Washington, and an instructor at the training school at Fort Meyer. He is the author of the treatises on weather service that have been studied by the officials for the past twenty years.

Missouri Balloon Students to Fort Omaha

St. Louis.—The first class of the Missouri Aeronautical Reesrves has completed training and has received orders to report at the Army Balloon School at Fort Omaha, Neb., where the men will receive their final training and commissions. They will depart for Fort Omaha tomorrow night.

Members of the class are Jules Monti, John H. McCawley, Rodermich Tait, Roland Tait, F. R. Wickard, R. L. Sparks, E. A. Henske, F. M. Murphy, E. T. Ferguson and Carl Axtater. Axtater has been ordered to report for duty in the aviation division of the United States navy.

The second class of balloonists has been organized with fourteen members. The Missouri Aeronautical Society has taken a lease on Meramec Park and will continue training men for the army all summer.

Lieut. Hiller, one of the instructors at the Gallaudet School of Aviation

More New Yorkers for Aviation Class

Plattsburg.—The following New York students have been detailed for the aviation class and will proceed to the school at Cambridge, Mass.: Stephen Bonsal, Jr., No. 51 Vanderbilt Avenue; Louis F. Plummer, New Rochelle; Arthur L. Tait, No. 434 Riverside Drive; J. R. Dunlap, Jr., No. 6 East Thirty-ninth Street; Gerald V. Carroll, No. 110 West 183d Street; J. W. Guard, No. 74 Broadway; Second Lieut. Edwin Mott, Roy Platon, A. F. Seaver, E. A. Griffiths, E. A. Nostrand.

Coffin Given Doctor's Degree

Ann Harbor, Mich.—Howard E. Coffin, attending the graduation exercises of the University of Michigan, addressed the assembly and discussed the war in its different phases. Mr. Coffin was given a Doctor of Engineering degree by the university.

Group of Army aviation students at one of the training fields

Lafayette Aid Squad to Fight for Pershing

The Lafayette Escadrille, an aviation corps composed exclusively of Americans, will shortly be transferred from the French to the American army, according to a press despatch. Arrangements to this effect have just been completed.

The Lafayette Escadrille first bore the Stars and Stripes over the French front. Later when the American flyers changed from the horizon blue uniform of the poilu they had the honor of being the first to fight in the olive drab of the American Army.

Our Aviators Begin Training

Washington.—The practical work of instructing America's big army of aviators will begin this week at the first of the new Government aviation training fields at Rantoul, Ill., and by July 15 the fields at Dayton, Ohio, and Mount Clemens, Mich., will be completed.

This announcement was made by Howard E. Coffin, Chairman of the Aircraft Production Board. He said that all records had been broken in the construction of the field at Rantoul, and that union and non-union men had worked side by side without friction in order to best serve the nation's interests.

Mr. Coffin said also that contracts had been let for enough training plants to start the task of instructing the aviators, and that while it would be impossible to obtain the full quota of planes by July 15 for the three fields, the work would not be seriously hindered. Twenty aviators will open the training field at Rantoul this week, and within another week or ten days the entire undertaking will be going at top speed.

It has been the general impression that practical training could not be started for some time, and the announcement came as a surprise to almost every one except the officials who have been preparing the fields. The experts here assert that America will develop its host of fliers with a speed that will amaze Germany and the rest of the world.

Mr. Coffin returned recently from a tour of the training fields.

"The construction work on Chanute Field at Rantoul has broken all records," Mr. Coffin said. "A half million dollars worth of buildings have been put up practically within a month. They form a village a mile long, and the speed with which they have virtually sprung out of the ground has been deeply impressive. A few weeks ago the big mile-square space was simply a collection of corn fields.

"The explanation for the speed with which the work has been done is the spirit which has filled the men engaged in it. Union men and non-union men are working side by side in the effort to advance the national interest. The only outward distinction is that the union men are working behind a big American flag, which is advanced as the job progresses. The sole idea which has occupied the minds of the workmen has been the desire to break all records on this war work. There are 2,000 men on the job, and there has not been a disagreement or row of any kind since it started. I was impressed with the fact that these men were doing their part in the nation's service just as earnestly as though drilling in the ranks with guns on their shoulders.

"Wars are now fought and won by nations in arms. Few of us can hope to serve in any heroic rôle or even carry a gun. Every science, industry, and trade now has its part to play. Our fliers will fight on the front in France, but the thousands of men and women whose labor will go to aid in equipping, training, and maintaining these airmen are also doing their share.

"There are 3,000 men working on the Wilbur Wright field at Dayton and 2,000 on the Selfridge field at Mount Clemens. The Dayton field is the most impressive, as it is more than twice the size of the others. It is intended to accommodate four squadrons instead of two, and is about one and three-quarters miles wide and two and one-half miles long. Orville Wright is actively superintending the work at Dayton.

"The preliminary training schools now training cadets will be prepared to send quotas of students to the training fields as soon as the fields are ready, and the work will be in full swing by the last of July. Arrangements have already been made for training planes, and although the full quota of machines will not be available by the 15th, the shortage will not be serious."

Staten Island News

The Staten Island School of Aviation at the present time is teaching about 15 students. They are being instructed in both land and water machines. The school has as instructors Tex Lagrone, Dan Probst and Tom Dean. There are in operation three land tractors, a Day, a Martin and a Harriman, and two flying boats, a Stevens and a Benoist.

Assignments to Officers of the Flying Corps

Maj. Benjamin D. Foulois, junior military aviator, Signal Corps, will proceed to Baltimore, Md., thence to Tolchester, Md., for duty in connection with the aviation service of the Army, and upon the completion thereof will return to his proper station.

Capt. George H. Brett, junior military aviator, Signal Corps, is detailed as a member of the board of officers appointed in paragraph 25, Special Orders, No. 129, June 5, 1917, War Department, to report upon types of storehouses for subdepots, with their necessary facilities and transportation and personnel, to include rules and regulations for administration.

Capt. Joseph C. Morrow, Jr., junior military aviator, Signal Corps, will proceed from Chicago, Ill., to Rantoul, Ill., for temporary duty in connection with the aviation service of the Army, and upon the completion of the duty enjoined will return to his proper station.

Capt. Walter G. Kilner, junior military aviator, Signal Corps, will proceed from Mineola, Long Island, N. Y., to Washington, D. C., and report in person to the Chief Signal Officer of the Army for temporary duty in connection with the aviation service of the Army, and upon the completion thereof will return to his proper station.

Activities of Flying Corps as Shown by Army Orders

By direction of the President, the following-named officers are detailed for service and to fill existing vacancies in the aviation section of the Signal Corps:

Majors—Capts. Frank P. Lahm, Cavalry (junior military aviator); Benjamin D. Foulois, Infantry (junior military aviator); William L. Patterson, Infantry (junior military aviator); Henry H. Arnold, Infantry (junior military aviator); John F. Curry, Infantry (junior military aviator); Townsend F. Dodd, Coast Artillery Corps (junior military aviator).

Captains—Capts. Aubrey Lippincott (Cavalry), now detailed in the Signal Corps; Hugh J. B. McElgin, Coast Artillery Corps; James Prentice, Coast Artillery Corps; Clarence C. Culver, Cavalry, detached officers' list; David H. Bower (Infantry), now detailed in the Signal Corps; Guy L. Gearhart, Coast Artillery Corps, detached officers' list; Harold Geiger, Coast Artillery Corps; Harry R. Vaughan, Coast Artillery Corps; Hollis Le R. Muller, Coast Artillery Corps.

First Lieutenants—First Lieuts. Frank M. Kennedy, Forty-sixth Infantry; Lewis H. Brereton, Second Field Artillery; Claud K. Rhinehardt, Seventeenth Cavalry; Thorne Deuel, Jr., Cavalry, detached officers' list; Harvey B. S. Burwell, Thirteenth Cavalry; Warren P. Jernigan, Cavalry; John Kennard, Seventh Cavalry; Edwin B. Lyon, Seventh Cavalry; Norman J. Boots, Tenth Cavalry; Leo A. Walton, Tenth Cavalry; William B. Peebels, Cavalry; Delos C. Emmons, Thirty-seventh Infantry; Tolbert F. Hardin, Forty-third Infantry; Arthur Boettcher, Infantry, detached officers' list; Edward L. Hoffman, Twenty-fourth Infantry; Norman W. Peek, Infantry, detached officers' list; Lewis C. Davidson, Infantry; John E. Rossell, Infantry.

The names of Capts. Clarence C. Culver, Cavalry, and Guy L. Gearhart, Coast Artillery Corps, and First Lieuts. Thorne Deuel, Jr., Cavalry; Arthur Boettcher, Infantry, and Norman W. Peek, Infantry, are removed from the detached officers' list, they having been detailed in the aviation section of the Signal Corps.

Other Assignments ....

Maj. James L. Dunsworth, junior military aviator, Signal Corps, now on leave of absence at Carrollton, Ill., will proceed to Rantoul, Ill., and assume command of the Signal Corps Aviation School at that place.

Capt. Arthur B. Christie, junior military aviator, Signal Corps, is relieved from duty at the Signal Corps Aviation School, Chicago, Ill., and will proceed to Fairfield, Ohio, and assume command of the Signal Corps Aviation School at that place.

Capt. Hugh J. B. McElgin, Aviation Section, Signal Corps, will proceed from the United States Army Balloon School, Fort Omaha, Neb., to St. Louis, Mo., for temporary duty in connection with the aviation service of the Army, and upon the completion of the duty enjoined will return to his proper station.

1,000 College Aviators

Washington.—More than a thousand university students have been admitted in the aviation ground schools at various universities. The total passed the thousand mark on June 30. The aviation cadets are distributed as follows: Massachusetts Institute of Technology, 182; Cornell, 188; Ohio State University, 154; University of Illinois, 162; University of Texas, 133; University of California, 185; total, 1,004.

These figures do not include Princeton and the Georgia School of Technology, which have now opened their "ground school" courses. Princeton will begin with 32 students and the Georgia Tech with 80. Counting the daily increase in all other schools, it is safe to say that the total number of cadets by now numbers something over 1,100.

Charles F. Willard, vice-president and chief engineer of the Aeromarine Plane & Motor Co.

School Grows Rapidly

Rantoul, Ill.—The latest approach to "a town sprung up over night" is being constructed on the new army aviation training field here. More than twelve hundred men, working Sundays and holidays, are putting up fifty-nine buildings and by July 20 it is expected that the population of this town will have increased from 1,690 to about six thousand.

The site at Rantoul is one of eight selected for training men seeking commissions in the reserve corps of the aviation section of the army. The stations at Chicago and Mineola, L. I., have been in operation for several weeks and others in the Central department of the army are being rushed to completion at Dayton, Ohio, and Detroit, Mich.

The local station is about fifteen miles north of Urbana, where, at the University of Illinois, most of the student aviators who will be "turned loose" here are to receive their theoretical training. The site was selected May 21, and the following day the contract was let to a firm at Champaign, Ill., for the construction of fifty-three buildings on the 640-acre tract. Last week six more hangars were added to the original number, making fifty-nine to be ready for use July 20. This means the completion of one building a day on an average. The contractors have been delayed in their work by a shortage of material, but already 115 carloads have been used and there are forty carloads of lumber in transit. It is estimated that more than 2,500,000 feet of lumber and forty tons of nails will be used. All lumber is being shipped from Southern points. The Kankakee & Urbana Traction Company has built a spur into the field and with their equipment in arms and munitions." cars are being switched from the Illinois Central Railroad to the traction line.

Buildings are being erected along the entire length of the north side of the field, as follows:

Eighteen hangars, 66x120.
Ten officers' quarters, 24x134.
One commanding officers' residence, 25x31.
One officers' club, 40x78.
One hospital, 78x118.
Six mess halls, 20x118.
Six cantonments or barracks, 20x336.
One power house, 35x37.
One gymnasium.
Two lattrines, 14x36.
One guardhouse, 20x50.
One schoolhouse, 96x200.
One aero supply building, 66x125.
One administration building, 40x80.
One "dope" house (gasoline storage), 35x62.
One blacksmith shop, 26x60.
One garage, 66x201.
One machine shop, 66x125.
One post exchange, 40x62.
One Y. M. C. A. building.

Every building will be strictly modern, thoroughly equipped, and will be heated from a central station. Electricity and water will come from the local municipal plants.

The field, which is a mile square, formerly had three sets of up-to-date farm improvements on it, but all are being torn down or moved off, and the trees, shrubbery, hedges and fences are being pulled. A gang of men with teams is leveling the tract, and when completed it will be as flat as it is possible to make it and will be sown to grass.

The work is all under the supervision of Captain A. C. Deacon and he is assisted by a corps of clerks.

Students in the aviation corps will receive two months' training at the University of Illinois and then will be sent to the Chicago or Rantoul fields for actual work. To every student engaged in flying there will be five carpenters and mechanics, who will be kept busy keeping the machines in running condition.

The people of Rantoul are just beginning to realize the effect the field will have upon the life of the village. Already business in every line has increased. Property is being bought and sold at big figures; new businesses are being started, and there is activity on all sides. The town expects to entertain hundreds of visitors daily, besides tripling its population.

Allied Air Chief Asks 5,000 American Flyers

Paris.—Monsieur Pierre Etienne Flandin, head of the Interallied Aeronautic Service in France, expects great things from the cooperation of the United States in military aviation. He said:

"It is from the air that the great republic can strike the blow that will be the most quickly felt by the enemy. Five thousand American aviators, bringing with them their own equipment in machines, would weigh more heavily in the balance of the war just now than 5,000 infantrymen or 5,000 artillerymen with their equipment in arms and munitions."

C. O. Prest, instructor of the Riverside Aircraft School, California, and one of his students, Miss Ruth Wightman

THE WITTEMANN-LEWIS TRAINING TRACTOR

MONTHS of continuous hard service, during which time it has been put through every possible maneuver, including seven successive loops, has shown the Wittemann-Lewis training tractor to stand up remarkably well under the most severe treatment. Since the machine was first put in operation, no repairs have been necessary, not even of a minor character, and this is especially noteworthy where landings are made at frequent intervals. An account of some of its performances was given on page 563 of the previous issue of Aerial Age.

Fittings throughout are principally chrome vanadium steel stampings, treated with heavy anti-rust plating. All exposed metal parts are enamelled over the rust proofing. Exposed wood parts are given a coat of wood filler and three coats of waterproof varnish and battleship-grey paint. Fabric is treated with five coats of dope, two coats of grey paint, and finished with two coats of waterproof spar varnish.

General specifications, dimensions, areas, weights and performances of the Wittemann-Lewis Model TT are as follows:

General Dimensions

Span, upper plane	42′ 0″
Span, lower plane	34′ 0″
Chord, both planes	5′ 6″
Gap between planes	5′ 6″
Total area of supporting surface	392 sq. ft.
Loading per sq. ft.	5.43 lbs.
Loading per b.h.p.	23.66 lbs.
Overall length	27′ 2″
Overall height	9′ 8″
Net weight, without load	1,530 lbs.
Useful load (pilot, observer, tools)	360 lbs.
Fuel load (four hours at full power)	240 lbs.
Total gross weight	2,130 lbs.
Motor, Hall-Scott	90 H.P.

Planes

The upper plane has an area of 223.21 sq. ft., not including ailerons. Aileron area, 28 sq. ft. Lower plane area, 206.8 sq. ft. There is no stagger or sweepback to the planes; although not indicated on the accompanying drawing, the planes have a dihedral angle of 1 degree, 30 minutes.

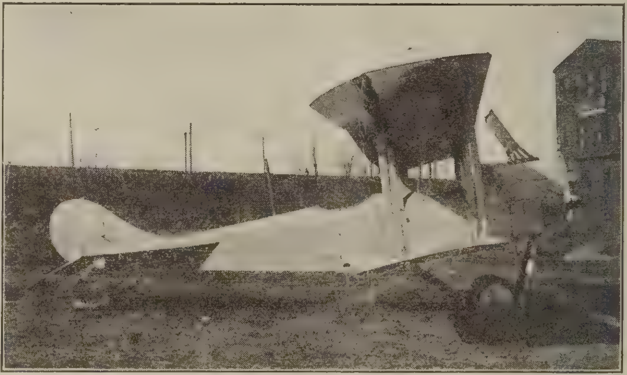
Upper plane is composed of three sections and the lower plane two. Ends are hinged and attachment made with nickel steel pins. The wing curve is the Wittemann-Lewis No. 7, which allows the use of two stout spruce main beams. Ribs are built up with solid spruce webs and ash battens. Wing tips are of ash and spruce, curved, raked and formed to the wing curve. The inner ends of lower planes are provided with veneer sidewalks for use in reaching the forward cockpit and in making adjustments to the motor. Hand grips are provided at the wing tips.

Interplane struts are of spruce, 66 inches long. Streamline section is constant 3½ by 1 inch, to within 15 inches of the ends, where it tapers in a straight line to a 2⅜ inches by 1 inch section.

Body

The radiator, at the forward end of the body is 20 inches wide by 38 inches in overall height. A 12-inch opening is provided through which the crankshaft of the motor projects. Immediately under the radiator, the drain cock for the water is located.

From the rear struts forward, the body is covered with aluminum. The curved top, to the rear of pilot's seat, is of aluminum. Cockpit openings are 33 inches by 22 inches, with leather-covered padded rims. At the rear cockpit, the body is 31¾ inches wide and 42 inches from the bottom to the top of curved cowling.



Side view of the Wittemann-Lewis Tractor

Dual Dep control is used, with an ash wheel yoke and ash and steel rudder foot-bar. The controls in the forward or student's cockpit are fitted with the Wittemann-Lewis release from pilot's seat, which automatically disconnects the front controls for safety in the event of misunderstanding by the student.

On the pilot's dashboard are mounted the following instruments and accessories. Foxboro air speed meter, air gauge, oil gauge and thermometer registering 220 deg. F.; Haustetter, "Tycos" barometer registering to 7,000 feet, inclinometer and level meter; Stewart-Warner revolution indicator; Dixie ignition switch; Imperial pump, and a rim-wind rim-set clock. A Pyrene fire extinguisher is held in a bracket at the floor, within easy reach of the pilot.

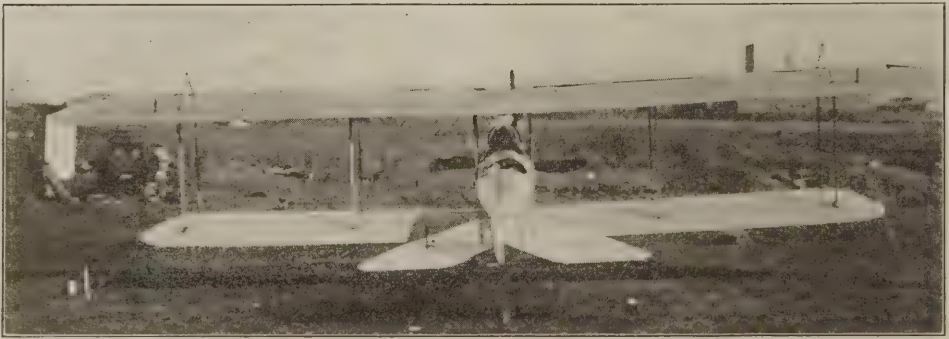
Landing Gear

The landing chassis is detachable, as a unit or individual parts may be removed for replacement. The strut members are of ash, U-shaped, the lower ends of which are separated by a pair of streamlined horizontal spreader stays of ash. The axle is of nickel-steel, 1½ inches in outside diameter. Shock-absorber retainers are of the Farman type, which eliminates all binding. Ten shock absorbing rings are used at each U member.

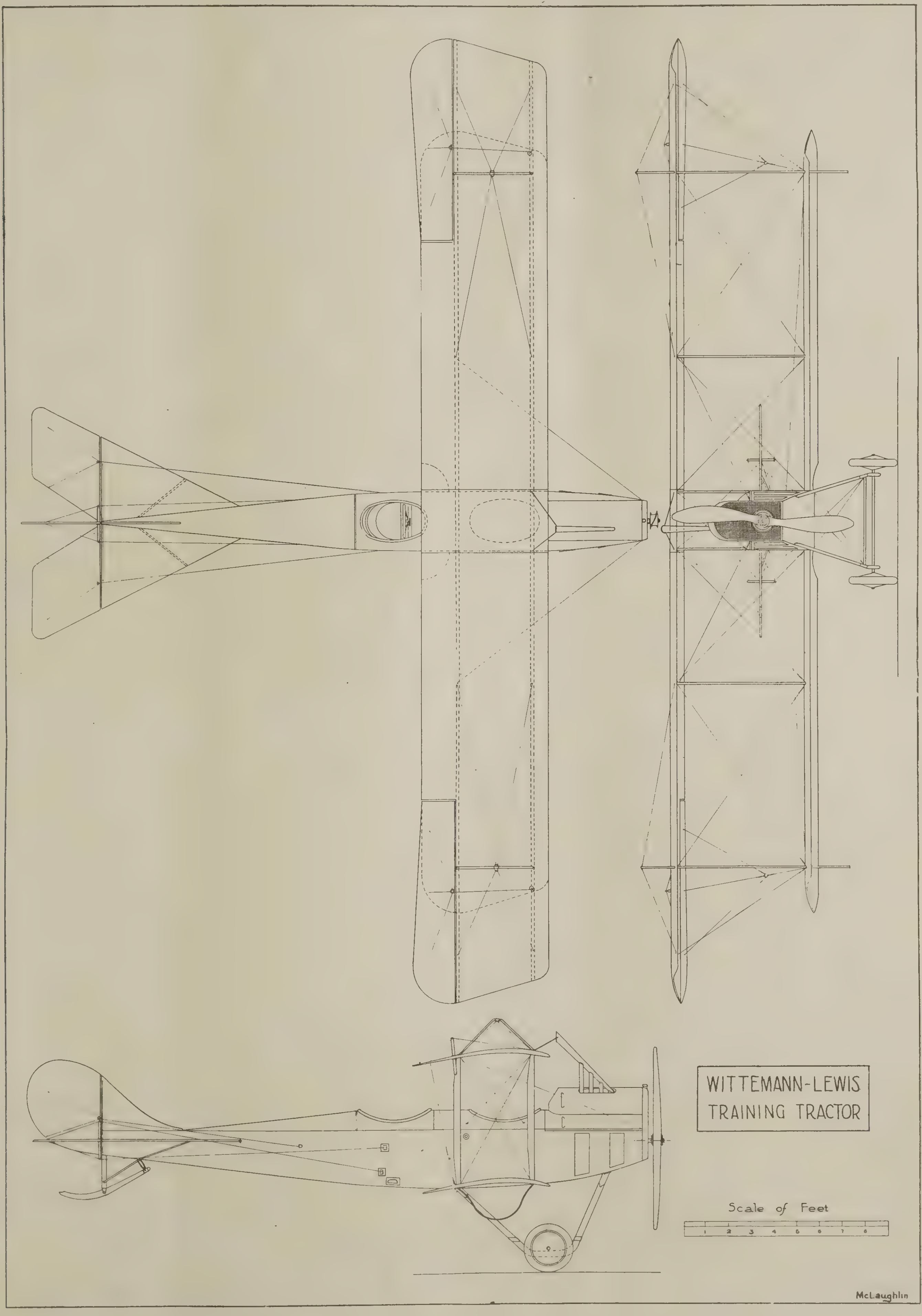
Wheels are shod with Goodyear tires, 26 inches by 4 inches. Fabric disc streamlining encloses the spokes, and the air valve is accessible through a small circular hole in the casing. The tread or track of the wheels is 5 feet.

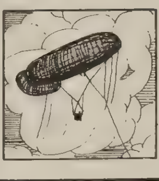
Tail skid is of ash, floating on a reinforced tubular cross member and aligned by heavy rubber cord

(Continued on page 610)

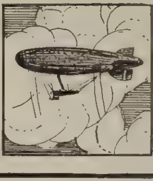


Rear view of the Wittemann-Lewis Aircraft Co.'s Training Tractor


WITTEMANN-LEWIS
TRAINING TRACTOR
Scale of Feet
McLaughlin



MILITARY AEROSTATICS



HYDROGEN FOR MILITARY PURPOSES

By Lieut.-Col. C. de F. Chandler, Signal Corps

(Continued from page 579)

Iron Contact Process

The iron contact process for production of hydrogen is often referred to as the regenerative steam and iron and method, the principle being that when steam passes over red hot iron it is decomposed into its constituent elements, the iron absorbing oxygen from the steam and the hydrogen collected. The chemical reaction is represented by the equation: $2Fe + 3H_2O = Fe_2O_3 + 6H$. To utilize this principle commercially, it is necessary to reduce the ferric-oxide back again to metallic iron which can be done by passing carbon monoxide over the iron oxide, the carbon monoxide (CO) taking an atom of oxygen from the iron becomes carbon dioxide (CO_2) represented by the following equation:

$$3CO + Fe_2O_3 = 2Fe + 3CO_2$$

The commercial equipment for production of hydrogen by the iron contact process utilizes the well-known water-gas process for making the carbon monoxide which is needed to reduce the iron from the oxide to pure metallic state. The water-gas generator is filled with coke which is heated to redness by a blast of air for very brief period. When steam is turned on to this red hot coke, it is decomposed, the hydrogen freed from the oxygen is combined with the carbon of the coke forming carbon monoxide (CO). The water-gas consists principally of hydrogen and carbon monoxide, but must be passed through washers and purifiers to remove dust and particularly sulphuretted hydrogen. Sulphur is removed by passing the gas over trays of iron. The purified water-gas, usually referred to as "blue gas," is then stored in a holder, available for use as reducing agent.

After steam has passed over the red hot iron for a few minutes, the temperature is lowered to such an extent that it no longer decomposes the steam and it is then necessary to raise its heat and at the same time change the ferric oxide to metallic iron by turning the blue gas into the ovens. The period of heating the iron and reducing the oxide requires about twice the amount of time for the hydrogen production phase.

Temperature is a most important factor and must be constantly watched in all phases of the process. In the water-gas generator, if the temperature is too slow, carbon dioxide is formed instead of carbon monoxide. In reducing the ferric oxide, if the temperature is not sufficiently high the reduction will be only from the ferric oxide Fe_2O_3 to Fe_3O_4 or at still lower temperature to FeO instead of to the pure metallic Fe.

The reduction ovens are originally filled with hematie (Fe_2O_3) which should be as porous as possible in order to expose greater surface to the action of the steam and carbon monoxide, and this ore should be free from sulphur compounds and other impurities. It is necessary to replace the ore in the ovens about every six months.

The iron contact process was developed long ago by Coutelle and perfected by Giffard in France, then developed commercially in England by Lane using several retorts for the iron. In Germany it was further developed by A. Messerschmitt, utilizing one large regenerative oven instead of many small retorts. The Messerschmitt regenerative oven is patented in the United States. The patents relate only to the oven and retorts; the steam and iron process is not patented. At least two firms in this country install iron contact plants, which produces 3,500 cubic feet of hydrogen per hour. Plants of this size and type are now under construction for the Navy Department at Pensacola, for the Army at Langley Field, and for a private firm near Akron, Ohio.

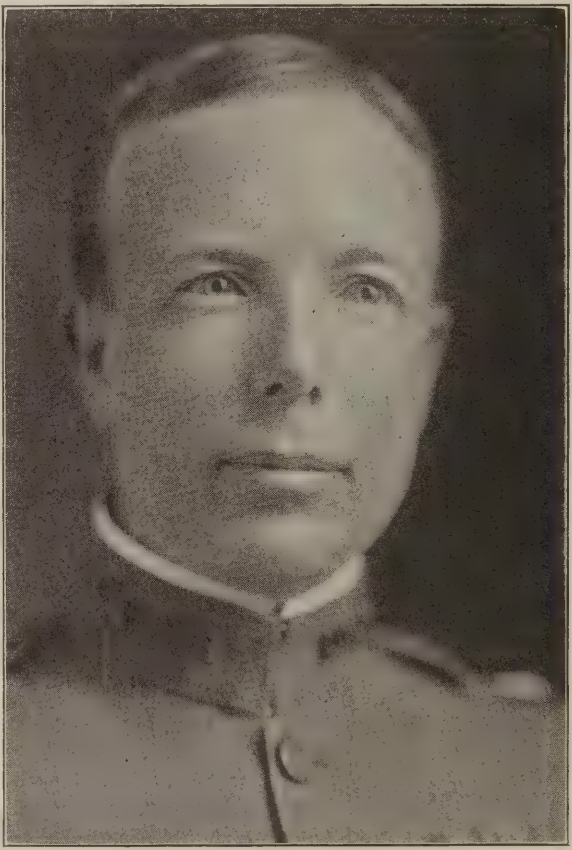
Hydrogen produced by the iron contact process has a purity of at least 98%. The impurities consist principally of nitrogen and carbon dioxide which have no deleterious effect on balloon fabric, nor are these gases inflammable. It is claimed that hydrogen can be produced by this process from 25 cents to 75 cents per thousand cubic feet.

Aluminum Caustic Soda Process

During the war between Russia and Japan both armies used field hydrogen generators employing the chemical reaction of alkaline hydrates upon aluminum. Sodium hydrate (NaOH) ordinarily known as caustic soda, is preferred to the potassium hydrate on account of the lower cost of the soda. The chemical reaction taking place is represented by the following equation:

$$6NaOH + 2Al = Al_2(ONa)_6 + 6H$$

The generating apparatus was constructed in two types, one of small size installed on vehicles for rapid transportation, and a larger size called "semi-fixed." An iron basket is filled with aluminum scrap, lowered into the solution of caustic soda, the cover being immediately clamped to make it gas tight. The gas passes from the generator to a washing and cooling device which removes the traces of alkaline matter.



Lieut.-Col. C. de F. Chandler

In the generator the aluminum is attacked by the soda solution with great energy, the gas coming off rapidly and the liquid heating to the boiling point, but as the proportion of free soda in the solution diminishes, the rate becomes slower. In order to finish the gas production without delay, the generator is charged with caustic soda considerably above the theoretical requirement.

According to the theoretical computation, it is found that to produce 1,000 cubic feet of hydrogen there are required 224 pounds of caustic soda and 51 pounds of aluminum. With caustic soda at 3 cents per pound and aluminum at 50 cents per pound, the cost of the one thousand cubic feet of hydrogen by this process is $32.22. The actual quantity of materials to be carried will be considerably excess of 275 pounds and the cost per thousand more than the foregoing computation indicates, on account of the necessity for using an excess of caustic soda and the fact that commercial caustic soda contains impurities, the most common grade containing only 77% sodium hydrate.

The aluminum and alkali method has the advantage of requiring about 20% less weight of material than the vitriol process and both materials being dry are easily transported without the especial care which is necessary for the transportation of sulphuric acid. Furthermore, the hydrogen produced is of greater purity, does not contain volatile hydrocarbons, nor the dangerous gases produced by combinations of hydrogen and arsenic.

U. S. patent was issued in September, 1901, for a modification of the aluminum-caustic-soda process. The inventor prepared the material by pouring molten caustic soda into a mass of aluminum in the form of powder, filings, or turnings, which was thoroughly mixed before the mass cooled. This mixture of material must be kept in sealed containers to avoid deterioration due to moisture in the atmosphere. When the mixed substance is placed in water the chemical reaction produces sodium aluminate and free hydrogen, probably according to the following equation:

$$2Al + 2NaOH + xH_2O = Na_2Al_2O_4 + xH_2O + 3H_2$$

or

$$2Al + 6NaOH + xH_2O = Na_6Al_2O_6 + xH_2O + 3H_2$$

Hydrolite

"Hydrolythe" is calcium hydride (CaH_2) manufactured by heating pure metallic calcium in retorts containing hydrogen. To produce hydrogen it is only necessary to drop the granulated hydrolythe into water. Generating equipment similar to the ordinary acetylene gas outfits are suitable. The reason hydrolyte is not more extensively used is on account of its high cost. About ten years ago the Signal Corps purchased a sufficient quantity to conduct experiments, which confirmed all claims for it, but chemical manufacturers in the United States do not produce it at present. It will be seen from the following chemical equations that only 59 pounds of hydrolythe are required to produce 1000 cubic feet of hydrogen, $CaH_2 + H_2O = CaO + 4H$.

At 80 cents per pound for hydrolythe the cost of 1000 cubic feet of hydrogen by this method would be $47.20.

Pure sodium or lithium dropped in water will produce hydrogen, and it is possible to make hydrides of lithium the same as calcium which will similarly produce hydrogen upon contact with water. On account of the light weight of lithium this would be particularly desirable for field hydrogen generation, and experiments are now in progress to determine whether it is practicable to manufacture lithium hydride at reasonable cost.

Dropping pure lithium in water would theoretically require only 40 pounds to produce 1000 cubic feet of hydrogen: $2Li + H_2O = Li_2 + 2H$.

And of lithium hydride 22½ pounds would produce 1000 cubic feet hydrogen $2LiH + H_2O = Li_2O + 4H$.

About ten years ago an American manufacturer proposed the use of lead compounds having great affinity for water known as "Hydrone A, B, and C," and experiments were conducted by the Signal Corps. It developed that the chemical reaction upon dropping the substance into an alkaline solution was so violent that the oxygen of the air above the generating tank would burn the hydrogen,—the ignition being due to heat of the chemical action. This difficulty was overcome by manufacturing a lower grade which evolved hydrogen slowly. The low grade material was first dropped into the generator until the escaping gas had carried with it all oxygen above the water, then the high grade substance was fed into the generator. On account of the extreme care that was necessary to avoid explosions with this method and the considerable weight of the hydrone, its further developement for field hydrogen generation in the army was discontinued. One pound of hydrone produced only 2.88 cubic feet hydrogen at a cost of 6½ cents per foot.

Hydrogenite

The hydrogenite process is a modification of the "silicol" process already described. The chemical substances and reaction are the same as the silicol, but the materials are prepared and used in somewhat different manner. Pulverized ferro-silicon and caustic soda properly proportioned are thoroughly mixed and preserved in hermetically sealed cartridges, each containing 50 kilograms.

The field generators to use these cartridges consist of metal container slightly larger than the cartridge, having a lid which can be clamped

Anti-aircraft guns used for defence against dirigibles.

down gas tight. After placing the cartridge in the apparatus, the top of the can is opened and the mixed powders ignited. Around the inside of the cylindrical burning oven in which the cartridge is placed, is a trough to contain a measured quantity of water. The heat produced by the burning of the chemicals quickly converts this water into steam, the silicon, soda, and water combining as in the previously shown equation describing silicol method.

Ignition may be started by a fuse or taper inserted in the powder or by placing on top a small quantity of some easily combustible powder in order to produce sufficient heat in one spot to start the combustion. The hydrogenite burns rapidly and without flame, like tinder; a cartridge of 50 kilograms being consumed in about ten minutes.

When the mixture is first ignited, the air in the chamber and products of combustion are permitted to escape until the pure hydrogen appears. The gas is passed through washing and cooling purifiers before being used.

It is learned that even with the greatest care generators are frequently destroyed by explosions, for which reason the process is not in general use.

Hydrogen from Water-Gas

A German chemist developed and advocated some years ago the production of hydrogen for aeronautical purposes by first manufacturing water-gas in the usual manner, which consists principally of hydrogen and carbon monoxide, passing the water-gas over red hot calcium carbide in the form of powder. The hot calcium carbide decomposes the carbon monoxide forming lime (CaO) and leaving carbon in the form of crystalline graphite. The inventor claims that minor impurities in the water-gas are almost entirely removed in the reaction, producing hydrogen of 99% purity. The report further stated that generating equipment was devised to produce 70,000 cu. ft. of hydrogen daily.

Hydrogen may also be separated from water-gas or coal gas by the fractional refrigeration process. Hydrogen liquefies under pressure at lower temperature than other common gases, so that from illuminating gas having a considerable percentage of hydrogen it is possible to cool and compress it with liquid air apparatus, drawing off first all other gases as they liquefy and leaving the hydrogen. This method is not in general use for commercial production for the reason that other methods offer more simple and more economical means of securing hydrogen.

The *Electrical Review* (Vol. 40) reported that M. D'Arsonval passed coal gas previously cooled to minus 80° C. through a Linde liquid air machine, obtaining 3,500 cu. ft. of hydrogen per hour, expending 12 to 15 h.p. Assuming coal gas to cost $1 per thousand and containing 50% hydrogen, the cost of material would be about $2 per thousand cu. ft. hydrogen, to which must be added approximately 60 cents per thousand for power, plus cost of expert attendance.

Aluminum-Potassium Cyanide Process

A French chemist a few years ago advocated the generation of hydrogen for aeronautical purposes by mixing aluminum filings with pulverized bichloride of mercury and potassium cyanide. After these ingredients are thoroughly mixed hydrogen will be produced by adding water. The powder has a density of 1.42 and must be kept in hermetically sealed cans. It is stated that experiments indicated 187 pounds of this material were required to produced 1,000 cu. ft. of hydrogen. The chemical reactions which take place should properly be represented by three or four stages, but may be sufficiently explained by the following single equation:

$$6KCN + 6H_2O + 4Al + 3HgCl_2 = 2K_3AlO_3 + 12H + 3Hg(CN)_2 + 2AlCl_3$$

Acetylene Process

In 1901 Mr. H. Houbon, a resident of England, invented and patented a process for making pure hydrogen from acetylene. He compressed the acetylene to 5 atmospheres in a Caillet steel bomb and ignited it by electric spark. The carbon precipitates in the form of fine soot leaving the pure hydrogen. It is stated that the process is without danger and calcium carbide for producing acetylene is very cheap, but it is not known that this process has ever been perfected for producing hydrogen in large quantities for aeronautical service.

By computation it is found that 180 lbs. of calcium carbide are required to produce 1,000 cu. ft. of hydrogen by this method.

$$C_2H_2 + Heat = 2C + 2H$$

Iron and Water Process

Recently an article in a German technical journal described a new method for securing compressed hydrogen of great purity. So far as known it has been employed only in laboratories, but it may be developed later on a commercial scale.

Powdered iron is mixed in water in a vertical steel cylinder, the liquid being subjected to a pressure of 300 atmospheres (5,410 lbs. per sq. in.) and the temperature raised to 350° C. The chemical reaction that takes place is sufficiently explained by the following equation:

$$2Fe + 3H_2O \rightleftharpoons Fe_2O_3 + 6H$$

from which it is seen that under this great heat and pressure the iron combines with the oxygen from the water, and the hydrogen may be removed at the top of the cylinder already compressed for storage in cylinders. The iron oxide may be easily reduced again to metallic iron, which is facilitated by its porous condition, due to the peculiar manner in which it is oxidized. Hydrogen obtained is said to have 99% purity, which can be further increased to 99.95% by being passed over charcoal. When iron contains sulphur, the sulphur is not attacked, but any carbon content in the iron is converted into carbon monoxide.

Silico-Acetylene Process

The silicides of calcium, barium and strontium ($CaSi_2$: $BaSi_2$: $SrSi_2$) are made in the electric furnace similar to the manufacture of calcium carbide. When calcium silicide is added to aciduated water, it is decomposed, leaving silico-acetylene in solution; the calcium oxide is precipitated. The solution is drawn off and evaporated, leaving yellow crystals of silico-acetylene Si_2H_2. When these crystals are added to alkaline solution such as caustic soda or potash, the silico-acetylene is decomposed, evolving hydrogen. It is reported that 163 lbs. of silico-acetylene are required to produce 1,000 cu. ft. of hydrogen.

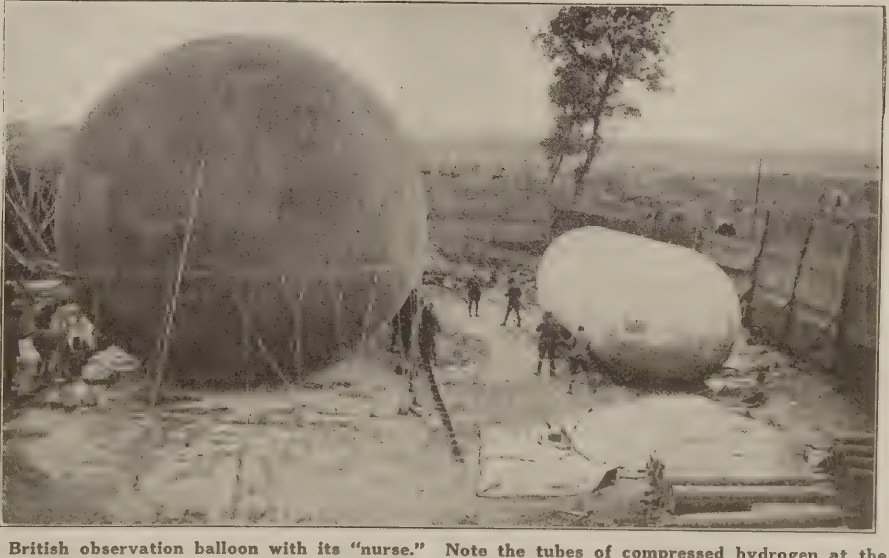
Decarburation of Oils

About four years ago the *Scientific American* described equipment developed by the German Army for the generation of hydrogen by the method of decarburizing hydro-carbon oils. The apparatus was designed for installation on two railway cars, the main part of the equipment consisting of two gas producers. To fire up these producers to the proper heat requires from one to two hours.

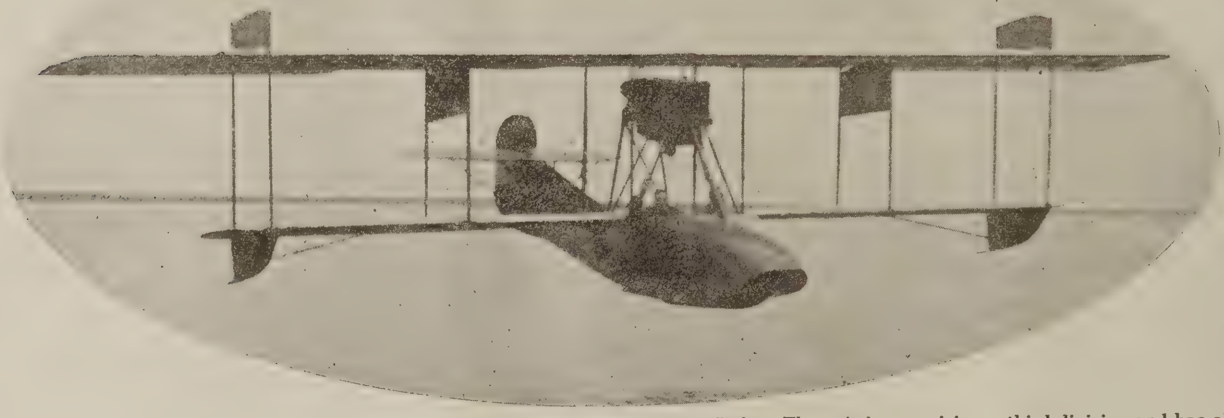
The producers are filled with coke which is heated to redness by air-blast. Crude petroleum or any petroleum distillates are first vaporized and then passed through the producer ovens containing the hot coke, which decomposes the oil. After about twenty minutes the coke has been reduced in temperature so much that it is necessary to heat it again to redness by hot air blast. This requires only two or three minutes.

The gas produced is passed through water scrubbers and purifiers to remove sulphur. It contains considerable carbon monoxide which is removed by pasing the gas through an oven, the details of which process are not stated. The resultant gas is said to be 98.4% hydrogen, 1.2% nitrogen, and 0.4% carbon monoxide, and to have a specific gravity between 0.087 and 0.092.

Balloon Division, Signal Office,
War Department,
June, 1917.



British observation balloon with its "nurse." Note the tubes of compressed hydrogen at the right of the photo.



Two members of Aerial Coast Patrol Unit No. 3, at Mastic, L. I., returning from a flight. The unit is organizing a third division and has already six seaplanes, mostly Curtiss flying boats. Applicants who wish to join should address Clinton D. Backus, Organizer, Aerial Coast Patrol Unit No. 3, Moriches, Long Island

ARMY AND NAVY NEWS

Capt. John F. Gallagher, Av. Sec., S.O.R.C., to report in person to Chief S.O. of Army for assignment to duty (June 26, War D.)

First Lieut. Lewis H. Brereton, Av. Sec., S.C., is rated as a junior military aviator. (June 27, War D.)

Major James L. Dunsworth, Jr. Mil. Av., S.C., to Rantoul, Ill., and assume command of the Signal Corps Aviation School at that place. (June 28, War D.)

Capt. Byron Q. Jones, Jr. Mil. Av., S.C., to Mount Clemens, Mich., and command Aviation School at that place. (June 28, War D.)

Capt. Arthur R. Christie, Jr. Mil. Av., S.C., to Fairfield, Ohio, and assume command of the Signal Corps Aviation School at that place. (June 28, War D.)

The following aviation students, Aviation School, San Diego, will report to board at San Diego, Cal., for examination for rating as junior military aviators: First Lieuts. Delos C. Emmons, 37th Inf.; Edward L. Hoffman, 24th Inf.; Edwin B. Lyon, 7th Cav., and Leo A. Walton, 10th Cav. (June 28, War D.)

Sergt. 1st Class George D. Litherland, 1st Co., 2d Aero Squadron, S.C., to company at Fort Mills, Corregidor Island, for duty. (May 10, P.D.)

Officers are detailed for service and to fill existing vacancies in the Aviation Section of the Signal Corps: As Majors—Capts. Frank P. Lahm, Cav.; Benjamin D. Foulois, Inf.; William L. Patterson, Inf.; Henry H. Arnold, Inf.; John F. Curry, Inf., and Townsend F. Dodd, C.A.C., all junior military aviators.

As Captains—Capts. Aubrey Lippincott (Cav.), now detailed in the S.C.; Hugh J. B. McElgin, C.A.C.; James Prentice, C.A.C.; Clarence C. Culver, Cav., D.O.L.; David H. Bower (Inf.), now detailed in S.C.; Guy L. Gearhart, C.A.C., D.O.L.; Harold Geiger, Harry R. Vaughan and Hollis Le R. Muller, C.A.C.

As First Lieutenants—First Lieuts. Frank M. Kennedy, 46th Inf.; Lewis H. Brereton, 2d Field Art.; Claud K. Rhinehardt, 17th Cav.; Thorne Deuel, Jr., Cav., D.O.L.; Harvey B. S. Burwell, 13th Cav.; Warren P. Jernigan, Cav.; John Kennard, 7th Cav.; Edwin B. Lyon, 7th Cav.; Norman J. Boots, 10th Cav.; Leo A. Walton, 10th Cav.; William B. Peebles, Cav.; Delos C. Emmons, 37th Inf.; Tolbert F. Hardin, 43d Inf.; Arthur Boettcher, Inf., D.O.L.; Edward L. Hoffman, 24th Inf.; Norman W. Peek, Inf., D.O.L.; Lewis C. Davidson, Inf., and John E. Rossell, Inf.

The names of Capt. Clarence C. Culver, Cav., and Guy L. Gearhart, C.A.C., and 1st Lieuts. Thorne Deuel, Jr., Cav.; Arthur Boettcher, Inf., and Norman W. Peek, Inf., are removed from the D.O.L., they having been detailed in the Aviation Section of S.C. (June 27, War D.)

Capt. Rufus F. Scott, Jr., Av. Sec., S.O.R.C., to report to commanding general, S.D., for duty. (June 27, War D.)

First Lieut. Harrison W. Flickinger, Av. Sec., S.O.R.C., to duty at Chicago. (June 27, War D.)

First Lieut. Norbert Carolin, Av. Sec., S.O. R.C., to Hampton, Va. (June 27, War D.)

First Lieut. William E. Lewis, Av. Sec., S.O. R.C., to duty at Aviation School, Rantoul, Ill., as supply officer. (June 28, War D.)

First Lieut. Daniel Buckley, Av. Sec., S.O. R.C., to Fairfield, Ohio, Aviation School, as supply officer. (June 28, War D.)

The War Department authorizes the following: The number of students now admitted to and studying in the aviation "ground schools" at various universities passed the 1,000 mark on July 2, the total being 1,004. The cadets are distributed as follows: Mass. Institute of Technology, 182; Cornell, 188; Ohio State University, 154; University of Illinois, 162; University of Texas, 133; University of California, 185. These figures do not include Princeton and the Georgia School of Technology, which opened their "ground school" courses on July 2. Princeton will begin with thirty-two students and the Georgia "Tech" with fifty.

Aviation Examining Board

A board of officers to consist of Capts. Thurman H. Bane, Aviation Section, Signal Corps; Guy L. Gearhart, Aviation Section, Signal Corps, and Henry J. Damm, junior military aviator, Signal Corps.

First Lieuts. Wm. R. Ream, Medical Reserve Corps, and Alfred H. Byars, Medical Reserve Corps, are appointed to meet at the Signal Corps Aviation School, San Diego, Cal., at the call of the president of the board, for the purpose of examining such officers as may be ordered before it with a view to determining their qualifications for rating as junior military aviators in the Aviation Section of the Signal Corps.

The following-named aviation students now at the Signal Corps Aviation School, San Diego, Cal., will report in person to the president of the board of officers appointed in paragraph 69, Special Orders, No. 149, War Department, June 28, 1917, for examination to determine their qualification for rating as junior military aviators in the Aviation Section of the Signal Corps:

First Lieuts. Delos C. Emmons, Thirty-seventh Infantry; Edward L. Hoffman, Twenty-fourth Infantry; Edwin B. Lyon, Seventh Cavalry, and Leo A. Walton, Tenth Cavalry.

Aeroplane Engine Laboratory

The national advisory committee for aeronautics authorizes the following:

At a recent meeting of the subcommittee on power plants of the national advisory committee for aeronautics, preparations were made for the development at the Bureau of Standards of a laboratory for testing aircraft engines under conditions of altitude and temperature similar to those encountered in flights at an altitude of 20,000 feet or more. The laboratory and its experimental equipment will be organized under the auspices of the advisory committee, and the investigations will be directed by the subcommittee on power plants.

The special immediate purpose of this proposed equipment is the prompt testing out of the so-called "All America" aeroplane engine, now under development, in order to be able to immediately put it under controllable conditions corresponding to any altitude and any atmospheric condition which would be met in the air.

Army Aviation School News

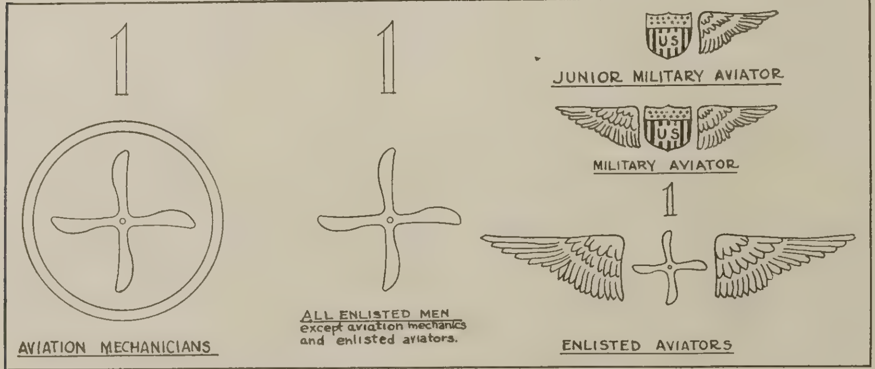
2d Aviation School Squadron and 1st Reserve Aero Squadron, Mineola, June 23, 1917. —Nearly 16,000 miles were flown in instruction flights at Mineola during the week. The total duration for the 461 flights was 211 hours. Sergeant W. K. Carruthers and Messrs. G. H. Keller and Phil. Knox, Jr., completed Reserve Military Aviator tests.

Signal Corps Aviation School, San Diego, Cal., June 12, 1917.—During the previous month training was carried on as usual; 2,060 flights were made, aggregating 1,087 hours and averaging, probably, 81,500 miles. Arrangements have been made to increase the instruction given enlisted men at this school. Among those receiving actual flying instruction are officers of the Regular Army, National Guard officers, enlisted men of National Guard and enlisted men of the Signal Corps. Some of the enlisted men of the Signal Corps and officers of the National Guard are flying alone. Ten officers have passed Junior Military Aviator tests during the month. Practical classes in motors are opening and closing continually for officers and enlisted men.

Signal Corps Aviation School, San Diego, Cal., June 16, 1917.—Four hundred and sixty flights were made during the week, with a total of 224 hours. Officers' classes are continuing in motors, motorcycles, construction and repair of aeroplanes and radio. Enlisted men are instructed in aeronautical motors and military work.

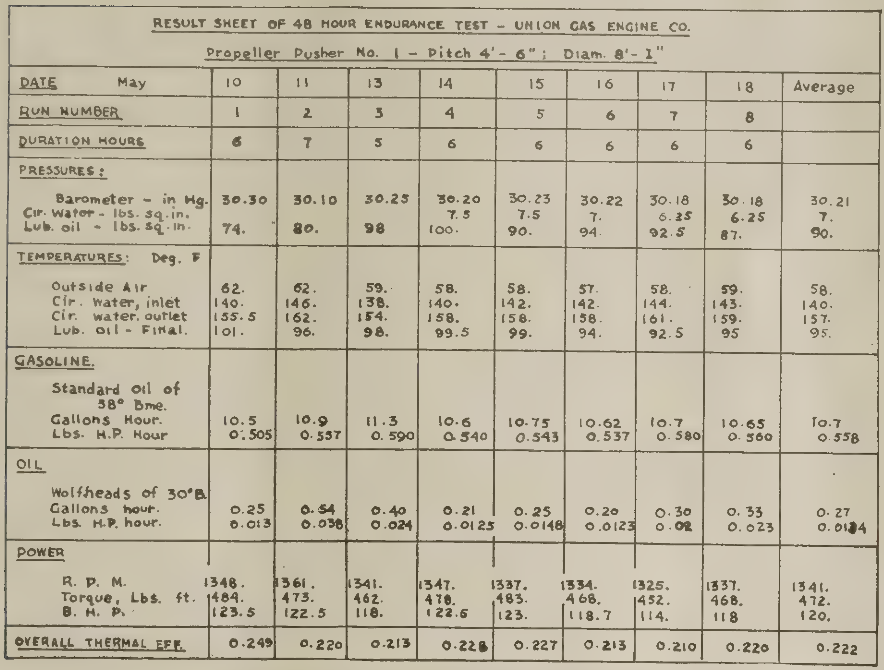
5th Aero Squadron, Camp Kelly, So. San Antonio, June 23, 1917.—The total of flights for the week was 156; duration 79 hours 16 minutes. Night and cross-country flights were made, during one of the latter of which a machine was forced to land while another machine flew over with spare parts. Among the machines in use by this squadron are: L.W.F.'s, J.N.4's, R.4's. Captains Seth Cook and W. W. Wynne have completed advanced training save for the night flying.

4th Aero Squadron, Camp Kelly, So. San Antonio, Tex., June 23, 1917.—Seven flights were made during the week, with a total of 6 hours.



The uniform insignia of the U. S. Aviation Service

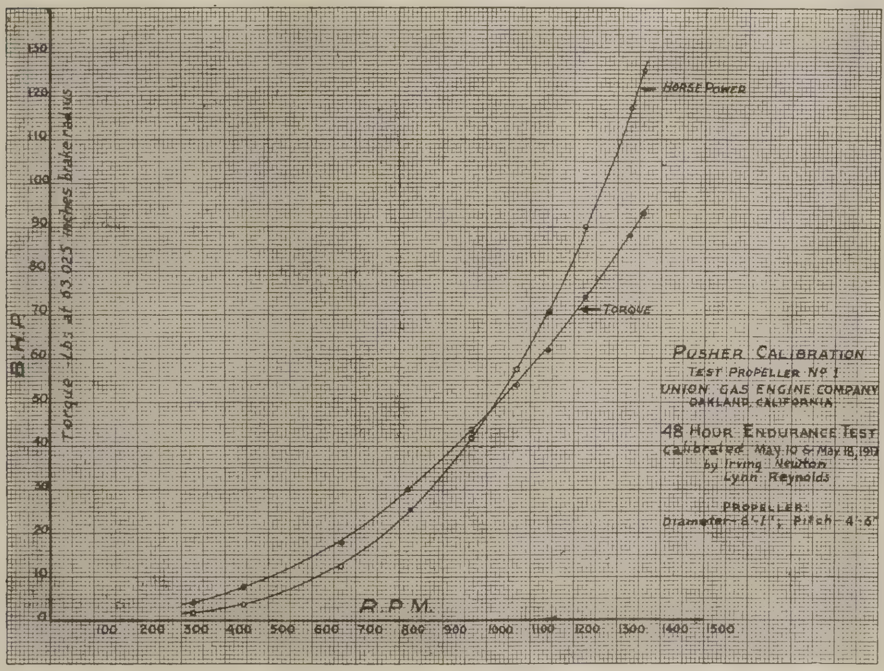
TEST CHARTS OF UNION AEROMOTOR



RESULT SHEET OF 48 HOUR ENDURANCE TEST – UNION GAS ENGINE CO.

Propeller Pusher No. 1 – Pitch 4'- 6"; Diam. 8'- 1"

DATE May	10	11	13	14	15	16	17	18	Average
RUN NUMBER	1	2	3	4	5	6	7	8	
DURATION HOURS	6	7	5	6	6	6	6	6	
PRESSURES:									
Barometer – in Hg.	30.30	30.10	30.25	30.20	30.23	30.22	30.18	30.18	30.21
Cir. water – lbs. sq. in.				7.5	7.5	7.	6.25	6.25	7.
Lub. oil – lbs. sq. in.	74.	80.	98	100.	90.	94.	92.5	87.	90.
TEMPERATURES: Deg. F									
Outside Air	62.	62.	59.	58.	58.	57.	58.	59.	58.
Cir. water, inlet	140.	146.	138.	140.	142.	142.	144.	143.	140.
Cir. water, outlet	155.5	162.	154.	158.	158.	158.	161.	159.	157.
Lub. oil – Final.	101.	96.	98.	99.5	99.	94.	92.5	95	95.
GASOLINE.									
Standard oil of 58° Bme.									
Gallons Hour.	10.5	10.9	11.3	10.6	10.75	10.62	10.7	10.65	10.7
Lbs. H.P. Hour	0.505	0.557	0.590	0.540	0.543	0.537	0.580	0.560	0.558
OIL									
Wolfheads of 30°B.									
Gallons hour.	0.25	0.54	0.40	0.21	0.25	0.20	0.30	0.33	0.27
Lbs. H.P. hour.	0.013	0.038	0.024	0.0125	0.0148	0.0123	0.02	0.023	0.0124
POWER									
R. P. M.	1348.	1361.	1341.	1347.	1337.	1334.	1325.	1337.	1341.
Torque, Lbs. ft.	484.	473.	462.	478.	483.	468.	452.	468.	472.
B. H. P.	123.5	122.5	118.	122.6	123.	118.7	114.	118	120.
OVERALL THERMAL EFF.	0.249	0.220	0.213	0.228	0.227	0.213	0.210	0.220	0.222



Pressure on our space last issue prevented us from presenting two very interesting charts of the tests of the Union Aeromotor, the product of the Union Gas Engine Company, Oakland, Cal. We give a résumé of the report herewith:

"The test was performed at the Union Gas Engine Company's factory, Oakland, California, and consisted of 48 hours' running made up of eight separate runs of six hours each on consecutive days from May 10 to May 18, inclusive.

"The engine was mounted on torque cradle frame; pictures and blue prints of this are enclosed. This test stand is of a similar design to that used at the Navy Yard, Washington, D. C. The rated output of 120 h.p. at 1,350 r.p.m. was obtained with a pusher propeller.

"The necessary calibrations were made of the thermometer and pressure gauges to determine their accuracy, also the brake arm radius was checked, the tare weight of the torque stand determined.

"The main test each day was started after a preliminary warm up of five minutes. Readings of all instruments were taken every thirty minutes and the hourly average entered on the Log Sheet.

"The r.p.m. were computed from the readings of a positive continuous counter, stepped down ten times, direct connected to the crankshaft. The torque was obtained from the readings of the spring balance scale. The b.h.p. computed by the standard S. A. E. formula, using the previous noted readings.

"The initial level of the gasoline in the feed tank was marked on the gauge glass. Every half hour the fuel level was brought to this mark, the quantity necessary to accomplish this being weighed and entered on Log Sheet. The summation of these represent the total consumption for the run.

"The oil consumption was obtained by weighing in the initial oil and weighing out that which remained in the tank at completion of each test.

"The engine performed a very satisfactory endurance test. Observations throughout the test showed that the vibrations were low, quick acceleration and good carburetion maintained, also the absence of oil leakage was another good feature as well as no evidence of water leakage at any of the joints.

"The maximum power developed was 123.5, while engine averaged 118 h.p. on last day, with an overall average of 120. Inspection of parts showed that with increase of piston clearance a higher average could be expected as the friction h.p. was excessive, due to drag of two pistons. (See piston inspection.)

"On the fourth day's test, Zeroline Special with a gravity of 20° Baume was used during a portion of the test, showing that this engine would perform satisfactorily with lubricating oil varying from 20° to 30° Baume gravity. The average oil consumption was 0.27 gals. per hour or 0.0124 lbs. h.p. hour, which is a good average figure.

"The average gasoline consumption was 10.7 gals. per hour, or 0.558 lbs. h.p. hour, while the overall thermal efficiency based on b.h.p. was 0.222. These figures show good carburetion.

"The engine demonstrated that its design and construction was such that it would stand endurance test of a much longer duration as when the run was stopped the engine was functioning very satisfactorily."

Personal Paragraphs

Waco, Tex.—Losing control of her aeroplane 200 feet in the air, Miss Hettie Nixon, 25 years old, was killed near Marlin, Tex., last week, when making a practice flight.

Her machine struck a telephone pole.

Terah T. Maroney, Seattle aviator, now at Washington, D. C., has resigned his commission as a lieutenant of the Washington naval militia to accept a post as instructor in aviation with the United States army. The resignation was accepted at the request of the naval militia bureau, which consented to Maroney's transfer to the land branch, where aviation instructors are needed at once. Maroney recently completed a course at the navy aviation school at Pensacola, Florida.

Jack Binns, wireless hero of the steamship Republic, left Brooklyn last week for Toronto, Canada, where he will join the Royal Flying Corps as an aviator. Binns enlisted for the service through the British recruiting office in Manhattan recently.

Army and Navy News

3rd Aero Squadron, Camp Kelly, So. San Antonio, Tex., June 23, 1917.—Flying to the total of 31 hours in 16 flights was done during the week, principally in cross-country flights.

4th Aviation School Squadron, Ashburn, Ill., June 23, 1917.—The week brought a total of 333 flights, totalling 140 hours and 42 minutes. Sergeants Schroeder, Thompson, Ortmayer and Alsip, Aviation Section, Signal Enlisted Reserve Corps, completed R. M. A. tests. Instruction continues in aerodynamics, electricity, meteorology, motors, field service and infantry drill regulations. Captain A. R. Christie, Signal Corps, U. S., is in charge.

1st Aero Squadron, Columbus, N. M., June 24, 1917.—Drills and classes in military instruction, radio, practical electricity and first aid. There was no flying during the week. Capt. W. A. Robertson, Junior Military Aviator, Signal Corps, U. S., is in command.

2nd Aero Squadron, Fort Mills, Corregidor, P. I., May 5, 1917.—The trials of interest were the observation, from the air of improvised bombs of explosive, fired by a coast artillery company in simulation of a projectile bursting on impact. Four flights totalling over 3 hours were made. Routine work and pistol firing during the balance of the week and the one following.

2nd Aero Squadron, Fort Mills, May 19, 1917.—Six flights were made totalling 5 hours 40 minutes.

2nd Aero Squadron, Fort Mills, May 26, 1917. Three flights: 1 hour 55 minutes. An examining board has convened to conduct examinations for rating as aviation mechanician, instruction having been concluded after a period of four months' activity. Capt. Wm. Lay Patterson, Signal Corps, U. S., is in charge of this station.

FOREIGN NEWS

CANADA

Toronto, June 26.—Information was cabled to newspapers here to-day that the aviator who brought down a German Zeppelin on May 22 off the coast of Holland is Flight Sub-Lieut. Robert Leckie of Toronto. He is a native of Glasgow but had lived in Toronto ten years and received his preliminary training here in 1915.

Canadian Army Headquarters in France, June 28.—In an air duel fought at probably the highest altitude at which aviators have met in conflict—nearly four miles—a Canadian triplane to-day pursued and defeated a German two-seated aviatik.

The German machine had sought safety by climbing. The triplane pursued. At a height of 20,000 feet the pilot of the German craft either fell or jumped from it and disappeared at the moment of the first burst of fire from the gun on the Canadian. The German observer then was seen to climb out upon the tail of his machine, where he lost his hold and plunged headlong. The aviatik turned its nose down and fell.

FRANCE

French Front in France, July 8.—Sergeant Andrew Campbell won in a fight with death with the chances a million to one against him while flying with the Lafayette squadron yesterday afternoon, say Press dispatches recently received. The lower left wing of his aeroplane broke off when he was soaring a mile high. Only his complete presence of mind and coolness saved him.

Campbell threw all the controls on the other side and volplaned some distance in order to detach the floating remnant of the broken wing, which was beating against the body of the machine and threatening to dislocate everything. Then, when he had succeeded, he descended slowly on the remaining wing into a beet field without injury to himself. The slightest turn in the air would have meant death.

This accident was preceded by the ceremony of the presentation of an American flag to the squadron by an employe of the Treasury Department at Washington. French and American aviators from several squadrons were paraded on the flying grounds for the ceremony, which was a fine spectacle of fraternity of the two nations. The famous Alpine Band played the national anthems of both countries.

Before the ceremony Corporals Campbell, Bridgman, Hewitt, Hinkle, and Drexel were promoted to Sergeants for bravery during recent operations. They, with others, have been operating along the whole front, where they drove off dozens of German fighting machines during the German offensive last week.

In the week from Jun 24 to Jun 30 the fought seventeen air duels, and as a result of their reconnoissances furnished the French with most valuable information. Lufberry and Willis had four engagements each, Bigelow and Lowell two each. Thaw, Haviland, Soubiran, Hall and the French Lieutenant de Maison-Rouge one each.

Hall, who is a newcomer after serving as a machine gunner in the British Army, while making his second flight with the Lafayettes was wounded severely, and was decorated with the military medal for attacking single-handed seven German airmen. Infantrymen on the ground stopped their fighting to watch the stirring combat which ended in Hall being wounded in three places. He lost consciousness at a height of three miles, but recovered his senses when within a hundred feet of the ground and brought his machine safely within his own lines.

Walter Lowell also suffered an accident. The motor broke down in the air, and the machine, out of control, descended astride a trench in the French lines. The unconscious aviator was taken from his machine by an officer, but it was found he was not seriously hurt.

GERMANY

Amsterdam, July 8.—A frontier correspondent of the *Handelsblad* reports that five persons were killed and several houses were destroyed during the bombardment of the German City of Essen, home of the great Krupp works, on July 7. A correspondent of the *Telegraaf* says bombs were dropped on the Krupp works, and that reports of damage inflicted are conflicting. Eestimates of the number of attackers vary between fifteen and forty. (The official French statement of Saturday night said one French aeroplane raided Essen, dropping bombs on the Krupp factory.)

On July 7 Allied airmen flew over the fortress region of Cologne, but no bombs were dropped, according to a semi-official statement received here from Berlin. Ludwigshafen and its environs were attacked, but the material damage there was slight and no one was injured.

On their return, the statement adds, the raiders attacked Karlsruhe but were driven off by artillery fire. They then dropped bombs on Treves without an apparent objective, and most of the bombs fell in the open country. Others caused damage to buildings, and one child was killed and a man injured. A French machine, the statement concludes, was forced to land near Saarburg, in the Rhine Province, by fire from anti-aircraft guns. The two occupants of the machine were made prisoner.

GREAT BRITAIN

July 7.—Thirty enemy aeroplanes swooped across London between 10:30 and 11 o'clock this morning at a height of 8,000 feet, dropping pewerful bombs, in the hope of wiping out the business centres of the city. The casualties, which folowed—the official account says that thirty-seven persons were killed and 141 hurt—and the damage which was done were inconsiderable compared to what might have been expected.

One enemy machine, downed by the Royal Flying Corps, fell into the sea at the mouth of the Thames. Admiralty reports from Dunkirk say that British aircraft sent up to intercept the Germans in their flight from London missed the raiding machines, but encountered and destroyed three enemy seaplanes and an enemy aeroplane. In a later encounter another aeroplane was brought down in flames, and a second was forced to land on the beach near Ostend.

When the fight was over London remained practically in its normal condition, except that thousands of people fought all the rest of the day to gain access to the scene of the action.

As early as 9:30 warning signs appeared in the city stating that enemy battleplanes were approaching over the east coast towns. Then came the shriek of sirens from Thanet, an soon heavy firing began.

Fly in Close Formation

One hostile raider, being damaged, was forced to put back to sea soon after reaching the coast. Thirty of the hostile craft made their appearance soon after, flying like migrating geese in close, arrowlike formation.

In these they made little attempt to reply to the fire of anti-aircraft batteries, but continued their comparatively deliberate flight toward London, keeping close to the north bank of the Thames.

By 10:20 they were passing a suburban town northeast of London, their formation now somewhat broken by the attacks of British fliers. At that time virtually the whole city of London was prepared to sight the raiders within five minutes. Bombs were falling in the suburbs to the northeast.

Although the ground haze rather hampered the British gunners, yet the aeroplanes' tactics differed from those of the last raid and the machines were plainly visible everywhere.

They split up into three parties immediately they came to London proper, the main body hastening to the centre of the city, while the others attacked the suburbs on the outskirts, their manoeuvres indicating that they were following a well-planned and carefully devised scheme.

Plainly Seen from Streets

Everywhere the anti-aircraft guns in the region of the great city were now firing with the utmost intensity. Nevertheless the enemy came on steadily, flying low persistently. The black crosses on their wings were plainly seen against the light gray framework.

Now they changed to battle formation, flying in three layers. British machines already were busy among them. One British airman was particularly daring. He plunged into the centre of a group of enemy fliers, scattering them in all directions, and then, turning sharply, repeated the performance. It was almost hand-to-hand fighting in the clouds, the batteries having ceased their fire for fear of hitting British planes.

The following official account of the raid was given out at noon:

"Lord French reports that at about 9:30 o'clock this morning hostile aircraft in considerable numbers, probably in two parties, appeared over the Isle of Thanet and the east coast of Essex. After dropping some bombs in Thanet the raiders proceeded in the direction of London. Moving roughly parallel to the north bank of the Thames, they approached London from the northeast. Then, changing their course, they proceeded north and west and crossed London from the northwest to the southeast. Bombs were dropped in various places in the metropolitan area.

"The number of raiding aeroplanes is at present uncertain, but probably was about twenty. They were attacked by artillery and by large numbers of our own aeroplanes, but reports as to the results of the engagements and as to damage and casualties have not yet been received."

In a report issued late this afternoon Lord French said the total casualties reported by the police were:

"Killed—Mertopolitan area, men, 27; women, 4; children, 3; total, 34; Isle of Thanet, men, 1; women, 2; total, 3; total killed, 37.

"Injured—Metropolitan area, men, 74; women, 29; children, 36; total, 139; Isle of Thanet, women, 1; children, 1; total, 2; total injured, 141."

Not until he appeared before the King last month to be decorated with the Distinguished Service Order did it become known to the public that Squadron Commander Edward F. Briggs, the first British airman to attack a Zeppelin base, and who was taken prisoner, had escaped from Germany. Briggs was captured in an attack on a Zeppelin factory at Friedrichshafen in November, 1914.

Commander Briggs, with four other British officers, was being transferred from a prison camp in Bavaria when they made their bolt for liberty. The four men jumped out of the railway coach and for two days and nights made their way over ploughed fields to the Dutch frontier. They were without food and suffered greatly from thirst. Briggs had been a prisoner for twenty-nine months.

ITALY

Rome, July 8.—Operations in the air form the chief interest of today's official Italian report.

"Yesterday afternoon," it says, "a large Italian raiding sqaudron, accompanied by pursuit planes, flew to Idria (about sixteen miles northwest of Gorizia). Notwithstanding the heavy anti-aircraft fire of the enemy, our aviators dropped two and a half tons of explosives on the military mercury extracting works, causing fire and other damage. Having carried out this difficult enterprise successfully, the aeroplanes returned safely.

"In the course of aerial fighting on the Carso, two enemy machines were brought down in our lines. A third fell within the enemy lines."

RUMANIA

The primary causes of the swift disaster suffered by Roumania, despite heroic efforts, in her struggle with the combined forces of Germany, Austria, Bulgaria and Turkey, have been related to a *Herald* correspondent by General Iliesco, Chief of Staff of King Ferdinand's army during the ill-fated campaign.

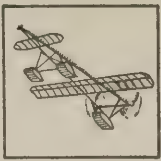
General Iliesco, in the course of his remarks, shows that the lack of trained men in the ranks and in the command, of light artillery and of aeroplanes was mainly responsible for the defeat of the Roumanian army, and he gives interesting facts in connection with these deficiencies. In emphasizing the necessity of thorough preparation for war and of strict discipline in the army General Iliesco says that America has no reason to fear militarism in the realization of her great war programme, and he mentions France as an example of a trained army in a democratic country.

General Iliesco said:

"The enemy also had a tremendous superiority in the number of aeroplanes, and this absolutely blinded the Roumanians and contributed *more than any other factor of their defeat.* Air supremacy is not only a question of a greater number of machines than the enemy, but also of constant improvement of type."

MODEL NEWS

Edited by G. A. Cavanagh



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29 West 39th St., New York City
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921 Ravenna Boulevard, Seattle, Wash.
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THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks,
Plattsburg, N. Y.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

The Best Length for Fuselages

(*Concluded from July 9th issue*)

"I cannot, of course, claim precedence, but I was pleased and proud' to find that my independent theories and experiments were on right lines. At the same time, I would point out that my machine differs from the 'Dunne' in that it requires a *tail*. Further, this member is (in marked contrast to any I have seen) *extremely short and close up to the wings.* My model was a seagull, and as an old yachtsman I know the value of a *short keel* when manœuvring in crowded waters, hence by analogy the short tail should give better command. And in practice my gliders will turn in a very small space, either horizontally or vertically, consequently they can be thrown or dropped in every conceivable position with only a momentary capsize, from which they recover instantly and sail off on an even keel. They do not possess undesirable 'automatic stability,' but rather what may be termed 'flexible equilibrium' like a yacht. Given sufficient 'air-room' they *could not dive.*

"Another discovery of possible interest was the V-shaped entering edge of beetle-wing cases. This probably serves to secure the folded wing, but (as the wing case itself serve a double purpose) it may also serve to imprison the air beneath the entering edge and assist its expulsion under the trailing edge. This suggests the experiment of downwardly returned entering edges, perhaps hinged as anterior ailerons."

—Courtesy *"Flight."*

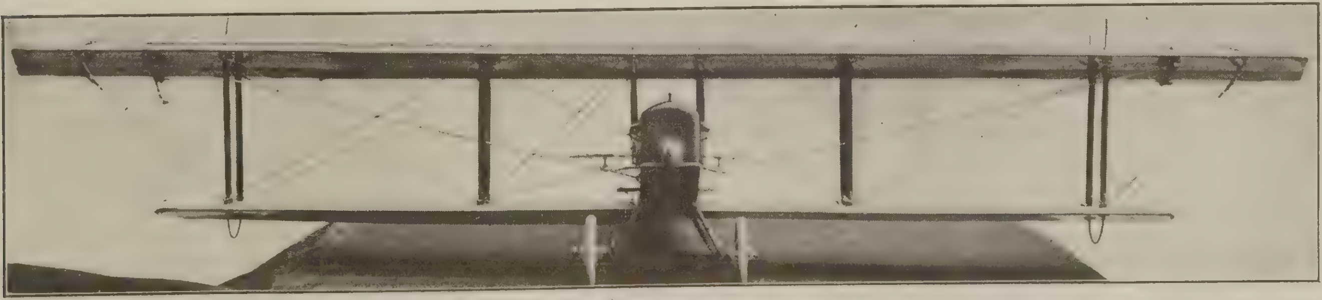
Aerial Acrobatics From an Aeromodellist's Point of View

Had anyone told the writer a short time ago that it would be possible for him to lie flat on his back and gaze vertically upwards through a pair of field glasses at an aeroplane executing a spiral *vol plané*, with respect to which he appeared to be in the exact axis, and that to that aeroplane would be fastened, of his own free will, a live, sane man, so directing this machine that, in popular language, it was executing this evolution upside down, he would naturally not have believed him. Had he also been told that he would have seen other evolutions just as remarkable, and carried through with just the same unerring judgment, coolness, and, above all, perfect confidence, he would have declined to listen to them. If, in addition to the above, he had also been informed that when lying flat on his back with the above-mentioned machine, to all appearance hurling itself vertically straight for him, he would not have felt the slightest thrill of uneasiness either for the man and machine up aloft or for himself on the ground, he would certainly have felt that this was the last straw; and had he been in a patient and amiable mood, he would have informed the person as politely as he could that he considered his prophecy somewhat replete with terminological inexactitudes. Had the mood not been a patient and amiable one, the expression would have been shorter and the adjective stronger.

And yet—incredible as it seems—the prophecy would have been true to the letter. The apparent impossibility has come to pass, and quickly, too, at that. What every expert aeromodellist, who can make his model perform, practically speaking, all the evolutions executed by leading exhibition flyers, desired to know above all things was: How far are these things possible with full-sized machines? No theoretical reasons could be brought forward why they should not be possible, rather the reverse; but theory is not practice always, and the laws of similitude, although the ordinary person is quite prepared to discuss them on paper or to put them into practice where there is no apparent risk, are not such that he is prepared to put his deductions to a practical test in which a false conclusion means certain death.

So far as the aeromodellist is concerned there is apparently no prospect of his experiments being repeated on a full-sized scale until some one comes forward prepared to spend tens of thousands of dollars in carrying out ordinary model experiments on a full-sized scale in machines fitted with automatic instruments of marvellous precision, reliability and exactness. The reason being that it appeared opposed to all human credibility that any man could be found who could *perfectly* (it is necessary to lay full stress on this word) eliminate the personal element when and where necessary.

(*To be continued*)



What better evidence can we give, that the mechanical driven model will soon surpass the rubber strand driven model, than to reproduce the model Curtiss J. N. Designed and constructed by William Kohler, alias "Wild Bill" of Los Angeles, California. It is unfortunate that we cannot give the complete description of the model in this issue, but Mr. Kohler assures us that this will be possible in the near future.

Aeronitis

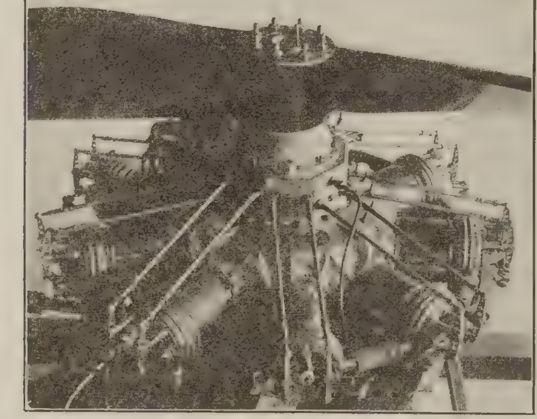
Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Notes on Constructing a Rotary Motor

Knowing that for reconnaisance machines a great deal of rotary motors are used, and being face to face with the fact that the United States is limited in the production of motors of all types, we have, after great investigation hit upon what we believe is an ideal plan for the cheap construction of rotary motors. Rather than patent our device, we have decided to print the whole story, and allow the engineers of this country to profit by our amazing ingenuity. If some of our technical terms do not seem to be used in the right sense, we hope our readers will pardon us in the knowledge that our intentions are good.

CANTO 1

Secure seven battered, single cylinder, motorcycles, and take therefrom the cylinders of the motors, being careful that none of the motors drop on your feet. (This is a very necessary precaution, as the feet are used largely in steering machines with Dep. Control.) If motor by accident does drop on the feet, swear softly, and remove. From each motorcycle take the pump handles, which will be found in the tool kit. These handles make excellent piston rods. Secure seven fairly strong tomato cans, and solder to top of pump handles. We now have the piston complete, except for the piston rings. We have found that an ordinary steel washer, when stretched to the correct diameter will be fairly good for a piston ring. (Be careful to stretch the washer by hand, as it must be accurate.) Next remove from the cylinders the valve push-rods, and substitute spokes from the wheels. You will find this will lighten the construction very much. (If the valves on the cylinders are at all worn, substitute the valves from the tires on the wheels.)



The completed motor, as used on the helicopter, showing extreme versatility.

SPASM 2.

Next, take from some iron junk heap two steel disks of a diameter of about sixteen milligrams, bore a hole in the center of each about eight ounces in radius, insert a rod which will fit the holes, and carefully attach the ends of the piston rods to this rod. Bore a number of holes around the circumference of the steel disks,—now being the crank case, and fasten together with strong bolts. In order to get good compression, close up all leakage holes with a good grade cement.

Pay no attention to such things as spark plugs. If this motor will run with spark-plugs, it is a pretty sure bet that it will run without them. (If it *does* run, drop us a line, we would be glad to know it.)

It is important that tomato juice be used as lubricant in the crank-case, for as the pistons were formerly tomato cans, they naturally will take more kindly to the use of such a lubricant. We believe that we have demonstrated a very cheap way of constructing a motor. In fact if such parts as we have described can not be found, they can very easily be stolen, with no more risk than a short term in jail for petty larceny. An added feature of our motor is the fact that two of the motorcycle tires can be used on the wheesl of the aeroplane, or if the machine is a flying boat, they may be used as life preservers.

Meeting of Aeronautic Inventors

The first meeting of the ancient and honorable order of aeronautic inventors was held in New York, on July 4th. One hundred people were in attendance, and as the inventor of the far-famed Odor-Engine and Accordion-Plane, we were elected honorable secretary. (There was no honorable treasurer. He absconded with the funds of the society within five minutes of their collection.) The meeting was opened auspiciously by a song, "Folks May Say I'm Crazy, but I Don't Care," by the President, after which drinks were served. This lightened the meeting somewhat and the conversation flowed more freely. (As the beer also flowed freely). Taking a copy of the United States Official Joke Books,—the Congressional Record, and the Patent Office Gazette, the last address of Congressman J. A. Oszk was read from the former, and then started a detailed description of the aeronautic patents for the last month in the Official Patent Office Gazette. The meeting has been in progress only three days, so there has not been enough time for the complete record to be read, and so we will have to wait until next issue before describing the meeting in detail.

We were recently asked by a gentleman of scientific inclinations, if there were any observations of aerial action which could be made from natural conditions near the ground. The variety of aerial turbulence disclosed by the fabrics of different specific gravity and different dimensions in feminine garments on any fashionable promenade on a windy day offer a splendid opportunity for an introduction to the study of aerial disturbances on the ground.

In the attempt to lick the World, Germany has at least learned to lick its plate.

Flights of imagination are no longer the pacemakers for flights of Aviation.

Col. Samuel Reber should be introduced to Uncle Sam with a reference emphasizing the fact that aeronautical engineering knowledge is rather a national asset than a coterie's perquisite.

The fickleness of fashion in the art of dressmaking may be more obvious than the fickleness of diversity imposed on aeronautical development by its amazing improvements, but it is less of an obstacle to standardization, Messrs. Ford and Willys.

Since German aviators have begun to bombard the kindergartens of England as a method of practice in the art of killing, we should advise our allies to disguise their schoolhouses as beer-gardens;—and incidentally it might be good practice to remove the Geneva Cross from the hospitals and replace it with a few stage guns. Defencelessness evidently invites ruthlessness.

A. C. BEECH.

"At the Mexican Border, I found an aviator worth a Cavalry Division." —General Pershing.

"An aviator is worth an Army Corps."—General Kitchener.

In September, the Government will select young men for different branches of the Service. Those who have had aeronautical training will be assigned to the Aviation Section, which is the preferred arm of the Service.

To any man physically fit, between the ages of 19 and 30, the Gallaudet Aviation School offers a splendid opportunity.

The School, located on beautiful Narraganset Bay, is *the* ideal hydro field and offers both land and water flying. The students at this school have the advantage of familiarizing themselves with construction work by visiting the Gallaudet factory in the immediate vicinity.

The course covers two months of intensive training under military regulations. The tuition is $600, giving the pupil 600 flying minutes.

INSTRUCTORS:

Phillips D. Rader, who has seen active service at the front.
John McGee, one of the most experienced and best known aviators in the country.
F. C. G. Eden, formerly of the Dodge School.

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We also make a "cleaner" or spar varnish remover with which spar varnish can be easily and quickly removed without in any way affecting the under coating of our special fire-proof dope. It makes the re-doping of any part or the whole of a surface a simple and easy matter and eliminates the necessity of disassembling and reconstructing the part affected, with a saving and economy that can be readily appreciated.

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The needs of the guns must often be served by more unwavering eyes.

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Our work for many years on balloons of any size and every type has put the former on a standardized basis, which simplifies specification and makes definite the direction of further progress.

The latter demanded newly directed labor in design and ungrudging research in the field—in our own country and abroad.

The result is the new Goodyear Kite Balloon.

Even as years of achievement have justified its Goodyear fabrics, exacting tests have justified its reinforced tail cups and the design of every part.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
AKRON

The Wittemann-Lewis Tractor

(*Continued from page* 601)

wound around the strut. There is a ground clearance of not less than 5½ inches under the fuselage termination when the skid reaches its vertical limit of travel.

Tail Group

The tail plane is divided at either side of the fuselage, situated 4½ inches below the upper longerons. At the trailing end, the tail plane measures 7 feet 6 inches across; it is 6 feet 2 inches in length. It is supported from below by a pair of tubular steel braces and at the trailing end by two pairs of steel wire braces.

Elevators measure 10 feet 2 inches from tip to tip. The leading edge is continuous across both elevators, and a small opening in the forward end of the rudder allows for movement.

Area of the horizontal surface, 38 square feet; area of the vertical surface, 17 square feet.

Motor Group

The motor installed is a Hall-Scott, which develops 90 h.p. at 1300 r.p.m. It swings an 8-foot propeller with a 5 foot 6 inch pitch.

Fuel tanks are placed under the front seat, and an aluminum wall separates them from the motor compartment. Pressure is used to supply the auxiliary tank from the main fuel tanks. An auxiliary air pump is used for starting, which also provides a safety factor in the event of the power pump failing while in flight.

(*Continued from page* 596)

the aerial operations against the German fleet and U-boat bases.

"When there was expressed the fact that 100,000 aeroplanes will be needed to make it possible to strike Germany through the air and thereby win decisive victories, a plan which was approved by the country at large, as shown by hundreds of press editorials approving the project, steps were taken to mobilize the aeronautic and allied industries so that the proposal to build 100,000 aeroplanes could be put into effect in the shortest time possible.

"Realizing the importance of producing aircraft in large numbers in the shortest time possible, manufacturers all over the country offered their facilities, and for the last month there have been waiting for orders factories that within ninety days after the placing of orders will be able to produce 3,000 aeroplanes a month and, two months later, 6,000 aeroplanes a month.

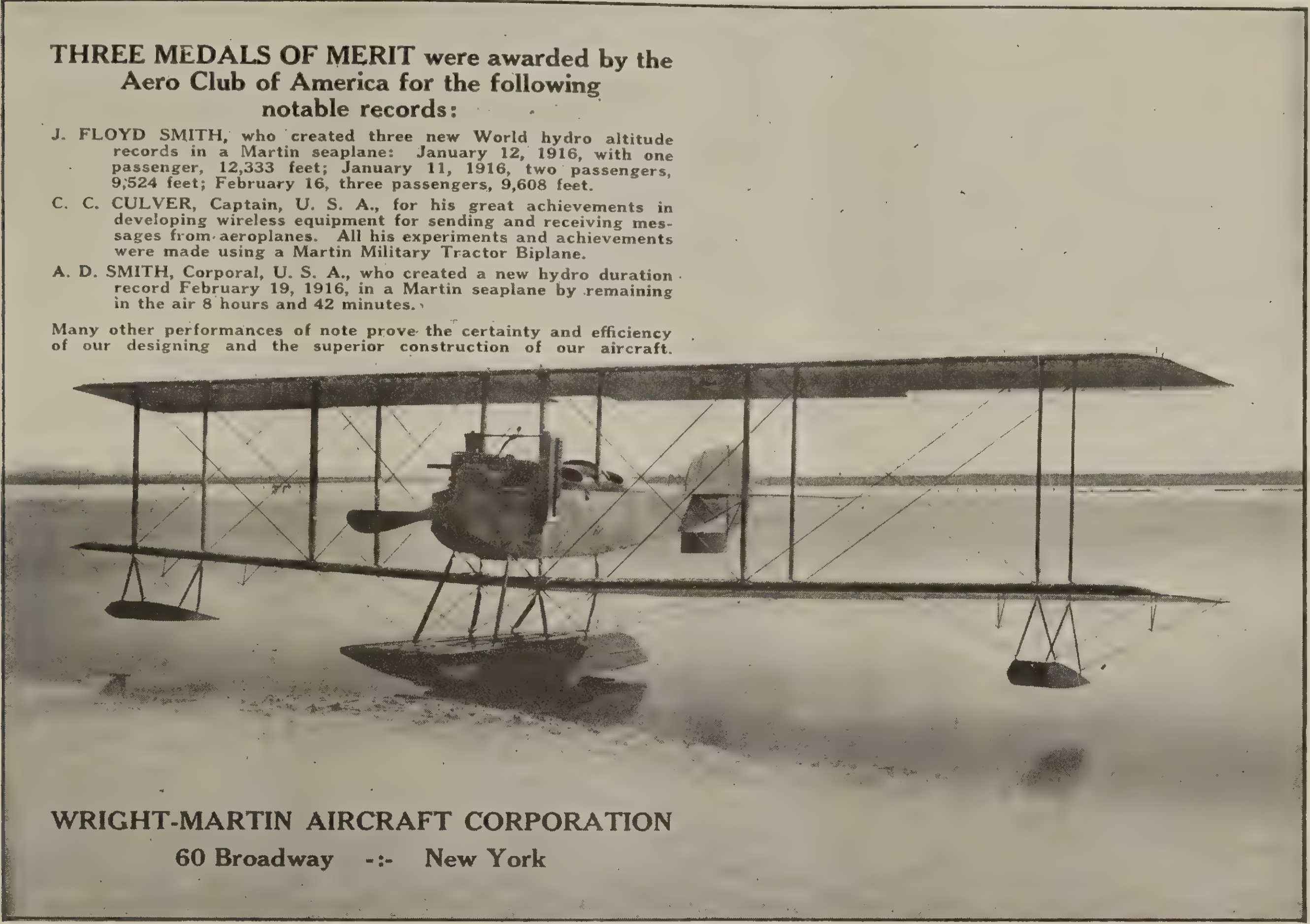
"If orders are only to be placed for 22,500 aeroplanes, then these aeronautic manufacturing facilities will be lost, since it is a costly proposition to hold factories idle waiting for orders.

"For major aerial operations against the German fleet and U-boat bases there will be required thousands of seaplanes of the largest type being built to-day, and to manufacture these will be required a large amount of lumber, which requires many months to dry properly, and other materials which require months to treat. While there is an abundance of green lumber and raw materials there is hardly any dry lumber to be had. Therefore there should be placed immediately the orders for the thousands of aeroplanes needed so that the manufacturers can get the lumber and dry it immediately.

"It is an accepted fact that the aircraft is to be the most important weapon with which to obtain decisive victories against Germany. It also is a fact that aircraft can be obtained in less time than any other type of weapon.

"We also know that, if the war should only be shortened by one week through our spending two billion dollars in aircraft—although we believe with sufficient aircraft and aviators the war can be shortened by a year—there would be a saving of tens of thousands of lives and tens of billions of dollars.

"Therefore we bring this matter to your attention, knowing that you will understand that our only motive is our feeling of duty and knowledge of conditions which we, who have followed the aeronautic movement since 1903 and have studied since the beginning of the war, in minutest detail. We realize that the above expressions may seem extreme to those who are not close to the subject, but it must be admitted that they do not seem half as extreme as the recommendations which we have made from time to time during the last three years to develop a sufficient and efficient air service."



THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

Many other performances of note prove the certainty and efficiency of our designing and the superior construction of our aircraft.

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Textbook of Naval Aeronautics
WITH A FOREWORD BY REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY
By **HENRY WOODHOUSE**
Member Board of Governors, Aero Club of America
Member National Aerial Coast Patrol Commission, etc., etc.

AN AUTHORITATIVE BOOK OF ABSORBING INTEREST

For all who wish to fly in the service of the Navy, or for pleasure, this work is indispensable. The general reader will find this record of the conquest of the air in the Great War as entertaining as the most thrilling fiction.

The official records of the amazing activities of the embattled air fleets are described and illustrated in detail. A comprehensive library on aeronautics is comprised in this single volume. Special chapters have been contributed by the leading authorities on aeronautics in America, including Rear Admiral Bradley A. Fiske, Rear Admiral Robert E. Peary, Elmer A. Sperry, Lawrence B. Sperry, and others.

The invaluable assistance of aircraft both in offensive and defensive operations, their revolutionary effect on the science of naval strategy, their value in supplementing the work of the fleets and in guarding our coastline from attack, are described in the light of their actual achievements in the Great War. The organization of the several aeronautic services in connection with the United States Navy is given in detail. The book presents in convenient form the latest official information concerning the aerial defenses of the fifteen Naval Districts, the administration of our naval aeronautic stations, the course of instruction required for the air service of the United States Navy, and a wealth of similar material.

In an appreciative foreword, Rear Admiral Bradley A. Fiske describes the book as "clear, correct, and stimulating."

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Army and Navy News

Capt. William K. Wallace, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the Chief of Staff for duty in his office.

Maj. John F. Curry, junior military aviator, Signal Corps, is relieved from duty in the Hawaiian Islands and will proceed on the first available transport to the United States, and upon arrival report by telegraph to The Adjutant General of the Army for further instructions.

Capt. Daniel M. Henry, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Mineola, Long Island, N. Y., and report in person to the commanding officer, Signal Corps Aviation School, for assignment to duty.

First Lieut. Howard P. Culver, Aviation Section, Signal Officers' Reserve Corps, will proceed to the Princton aviation field, Princeton, N. J., and report for duty at that place.

Capt. Byron Q. Jones, junior military aviator, Signal Corps, will proceed from Washington, D. C., to Mount Clemens, Mich., and assume command of the Signal Corps Aviation School at that place.

Capt. Rufus F. Scott, Jr., Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding general, Southern Department, for assignment to duty.

First Lieut. Daniel Buckley, Aviation Section, Signal Officers' Reserve Corps, is relieved from duty in the Southern Department, and will proceed to Fairfield, Ohio, and report in person to the commanding officers, Signal Corps Aviation School, at that place, for assignment to duty as supply officer.

First Lieut. William E. Lewis, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty, and will report in person to the commanding officer, Signal Corps Aviation School, Rantoul, Ill., for assignment to duty as supply officer.

First Lieut. Norbert Carolin, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Hampton, Va., and report in person to the commanding officer, Signal Corps Aviation Experimental Station, at that place, for assignment to duty.

First Lieut. Roderick H. Jones, Aviation Section, Signal Officers' Reserve Corps, is announced as on duty that requires him to participate regularly and frequently in aerial flights from June 11, 1917.

First Lieut. Harrison W. Flickinger, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Chicago, Ill., and report in person to the commanding officer, Central Department, for duty.

First Lieut. Lewis H. Brereton, Aviation Section, Signal Corps, is announced as having been on duty that required him to participate regularly and frequently in aerial flights from May 24 to June 16, 1917, both dates inclusive. Lieut. Brereton is rated as a junior military aviator.

First Lieut. Byron B. Daggett, Signal Officers' Reserve Corps, is relieved from duty at the United States Army Balloon School, Fort Omaha, Neb. He will proceed to Washington, D. C., and report in person to the Chief Signal Officer for duty in his office.

First Lieut. Fred A. Post, Aviation Section, Signal Officers' Reserve Corps, is announced as on duty that requires him to participate regularly and frequently in aerial flights from June 5, 1917.

The board of officers appointed in paragraph 12, Special Orders, No. 198, War Department, August 24, 1916, for the examination of officers to determine their qualification for rating as junior military aviators in the Aviation Section of the Signal Corps is dissolved.

Uses of Battleplanes

In a most interesting talk before the members of the S. A. E., Lieut. Amaury de La Grange of the French Commission discussed the various classes and uses of battleplanes. He explained that there are three classes of machines—the fighters, the reconnaissance and the bombing. Both the reconnaissance and the bombing machines are able to carry out bombing operations, but while the reconnaissance machine handles a 200-lb. bomb, the bombing type carries 2 tons of high explosives.

The fighting type must have speed, handiness, ability to climb and must be able to maintain a high altitude. None of these factors must be subdued to attain any other. These machines must be able to fight at great altitudes, and the lieutenant stated that it is not unusual to meet a German machine at a height of 18,000 ft. Probably the thing that the pilot tries the most in his machine is its handiness, and in attaining this, speed is one of the most important factors. The judgment of the pilot on a fighting machine is the final court, and it is he who must decide the success or failure of any given design.

The Allied machines have heretofore been more handy than those of the Germans, and this is the reason why they have been so successful. The skill of the Allied pilots has also been a factor, and the Lieutenant mentioned one named Ginnere, who is so skilful that he often attacks a German machine without himself being seen until it is too late. This is done by approaching at an angle which he knows renders him invisible to the foe, due to the construction of the other machine.

The reconnaissance machine must have the same qualities as the fighters, but they must carry more weight. In addition to the pilots they have an observer, more fuel and a supply of bombs. The pilots of these machines are less skilful as a rule than the fighters.

Night flying in reconnaissance machines is increasing, owing to the fact that the Germans move the troops in large bodies only at night, and it is possible to learn only by night flying if the enemy is concentrating five or six army corps at any particular place. This is determined very often by watching the number of trains going through a certain station. The way the aviators are able to land at night by means of gasoline flares with a searchlight indicating the direction in which to enter the field which is surrounded by the flares was explained.

New types of engines are tested in a standard manner by the French authorities. If it is an entirely new type it is given a 50-hr. test covering 5 days twice a day for 5 hrs. If it is a 200-h.p. engine the first half hour in each test will be at 200 h.p., and then the remaining test of 4½ hrs. is made at 180 h.p. A motor loses one-tenth its horsepower at 6,000 ft. elevation.

When an engine of a known type is tested it is run for 3 hrs. on a block, then torn down and inspected, reassembled and run for 20 minutes. The engines are now weighing 2 lbs. per horsepower and less, and naturally must be constructed of the finest material. The speaker stated that cast-iron cylinders were better at speeds of 2,000 r.p.m. and over, and the steel is not satisfactory for the cylinders in very high-speed engines. The reason for this is that the steel cylinder becomes too hot above 1,700 r.p.m. The lieutenant stated that the types of engines giving the best service vary from time to time, but at present the Hispano-Suiza, Clerget and Rolls-Royce are doing particularly well.

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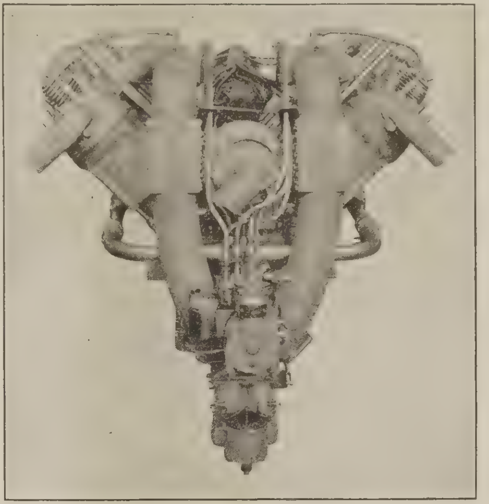

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THE WILSON CABINET COMPANY announce that they have a large plant containing 50,000 feet of floor space, with equipment ready to immediately manufacture aeroplanes of all types to specification. Correspondence invited concerning details of the facilities available.

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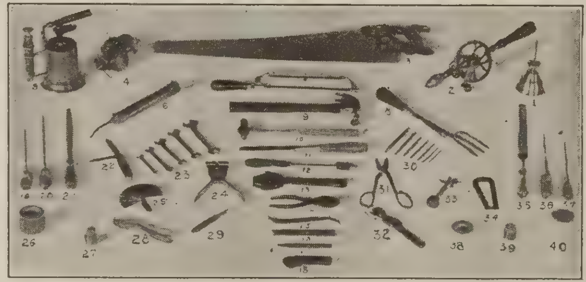
A Pilot's Necessity



THE accompanying illustration shows the compactness and completeness of the Cooper Aeronautical Tool Box. With the assortment of tools shown the weight is only 44 lbs.—usually 60 lbs. are allowed for tools on Military machines.

After five years of flying experience these tools have been selected to meet every requirement for Aeroplane service. The size of the box is 28 x 9 x 10 inches.

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No knots and no sap pockets. 10 to 40 foot lengths.

90 percent 18 feet and longer.

3 inches and thicker, 6 inches and wider.

65 percent vertical grain. This finest and highest grade of airplane spruce is becoming very rare. The spruce log from which it is obtained has within 30 days nearly trebled in value as the log lies on the ground or in the raft in the water. It is now necessary to send a representative out in the woods or out in the motor boat to get these spruce logs and haul them specially to the mills. I have five car lots (approximately 25,000 feet each) in transit, and a few cars for prompt shipment which are offered subject to prior sale. Prices quoted upon application.

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TYPE A7a, FOUR-CYLINDER VERTICAL, conservatively rated at 100 H.P., at 1,350 R.P.M.

This well-known engine is the most ideal equipment the market affords for use in connection with primary or advanced training machines.

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This "BIG SIX" Engine is the latest development of the HALL-SCOTT FACTORY, and is particularly adapted for use in heavier type land and water machines.

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The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

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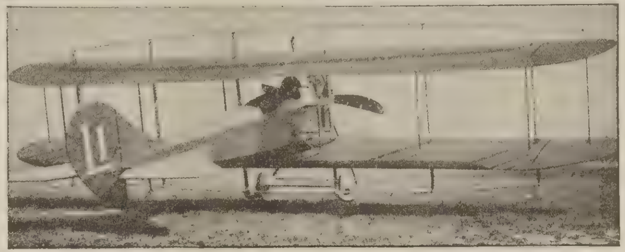

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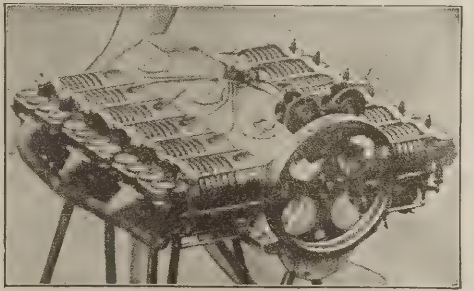

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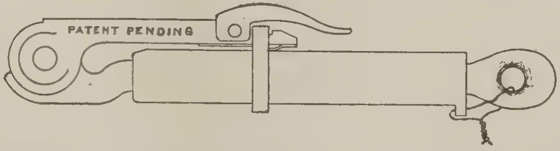

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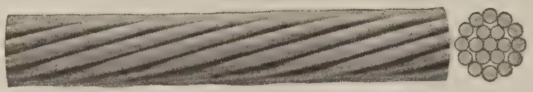

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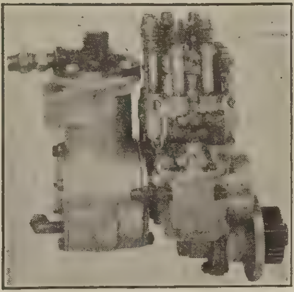

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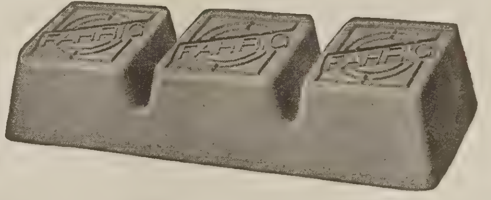

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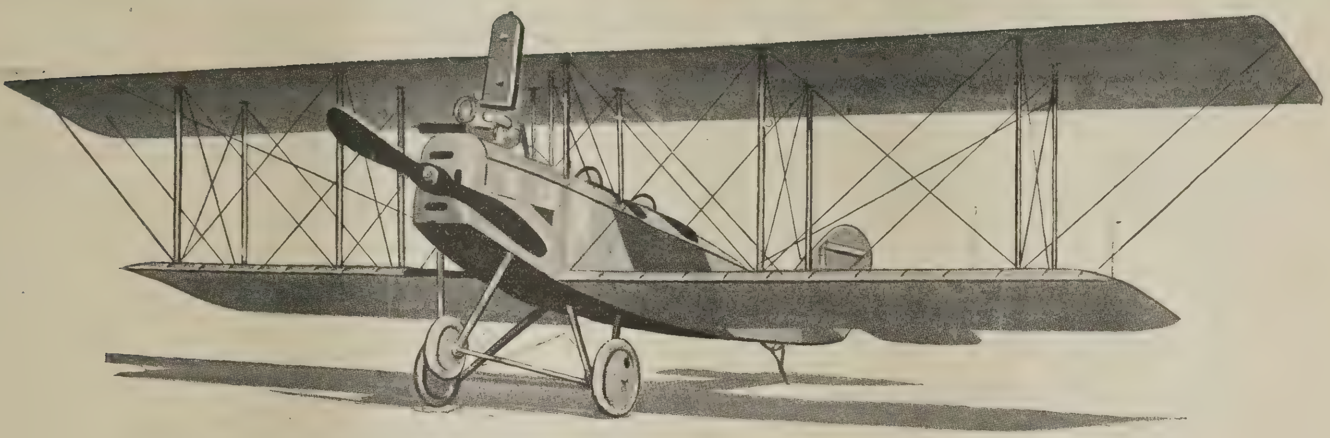

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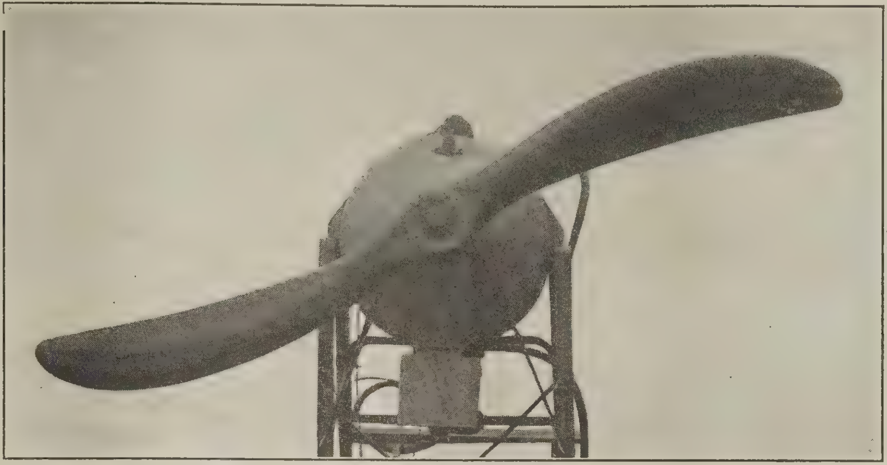

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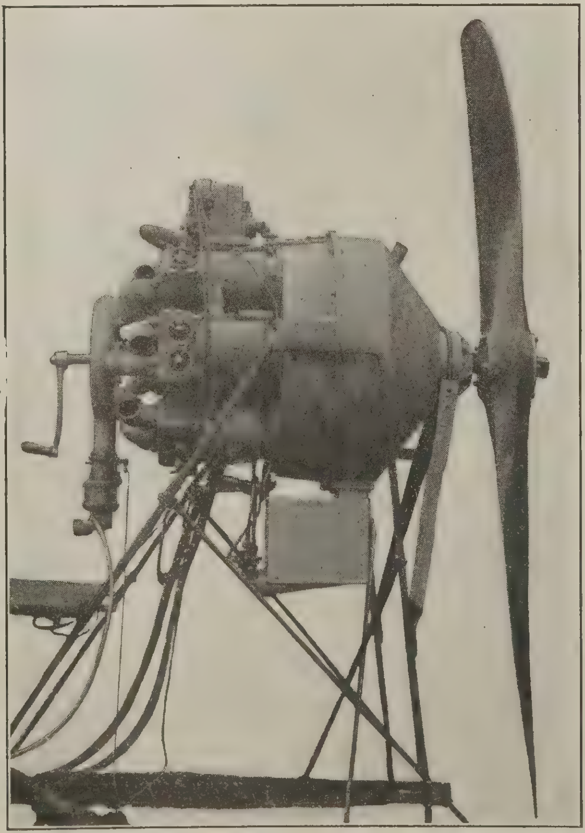

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VOL. V NEW YORK, JULY 23, 1917 No. 19

$640,000,000 AERONAUTIC APPROPRIATION PASSES HOUSE OF REPRESENTATIVES WITHOUT DISSENTING VOTE

WITHOUT a single dissenting vote the House of Representatives on July 14th passed the appropriation of $640,000,000 for military aeronautics. The Bill now goes to the Senate, where it is expected that prompt, favorable action will be taken.

The threatened opposition of some members of Congress was dispelled by the flood of facts regarding the importance of aeronautics let loose by Senator Morris Sheppard, of Texas, and Congressman Murray Hulbert, of New York, in the hearings on the Sheppard-Hulbert Bill providing for the creation of a Department of Aeronautics, and by the Aero Club of America's energetic campaign of education.

Before the hearings began, only Senator Sheppard, Congressman Hulbert, the Aero Club of America, the National Aerial Coast Patrol Commission, and the editors of *Flying* and AERIAL AGE dared to point out the absolute need of appropriations ranging from $500,000,000 to $1,000,000,000 for aeronautics. They were derided as absurd in some quarters, but just then the New York *Times, Sun, American, Herald* and *World* gave the movement their support.

Appreciating the need of bringing out the facts about the tremendous value of aeronautics and the vital necessity of starting on a substantial aerial program, Senator Sheppard and Congressman Hulbert started the hearings before the Senate Sub-Committee on Military Affairs on the Sheppard-Hulbert Bill, which would create a Department of Aeronautics, and brought forth the endorsement of leading authorities of not only the plan to train thousands of aviators and build tens of thousands of aeroplanes, but also a strong general endorsement of the Sheppard-Hulbert Bill.

The hearings began June 12th. Those who testified before the Senate Sub-Committee on Military Affairs, and subsequently before the Sub-Committee of the House of Representatives, and endorsed the plan to establish a Department of Aeronautics, included: Rear Admiral Robert E. Peary, Major L. W. B. Rees, of the British Royal Flying Corps, member of the British Commission in the United States; Howard E. Coffin, Chairman, Aircraft Production Board; Brigadier General George O. Squier, Chief Signal Officer, U. S. A.; Alan R. Hawley, President of the Aero Club of America; Henry Woodhouse, Henry A. Wise Wood, Augustus Post, Rear Admiral Bradley A. Fiske, Lieut. Rumsey and Lieut. Prince, members of the Lafayette Flying Corps; J. Bernard Walker, Editor in Chief of *Scientific American;* F. H. Allen, one of the Directors of the Lafayette Flying Corps; Maj. General Goethals, Joseph A. Steinmetz, President of the Aero Club of Pennsylvania.

Their testimony was printed daily in hundreds of newspapers throughout the country, and with the strong campaign of education conducted by the Aero Club of America at the same time, brought forth hundreds of editorials in the press throughout the United States.

It is of extreme regret to us that we cannot publish in full the most convincing testimony of the above-mentioned authorities.

On the floor of Congress, Congresman Hulbert, on the day of the passage of the Bill, delivered an address which is a classic in convincing facts, and which swept aside the petty objections of the few members of Congress who stood in the way of the passage of the Bill.

The aeronautic movement is greatly elated over the passing by the House of Representatives of the $640,000,000 appropriation for aeronautics. On that account, the Aero Club of America was today a center of activity, the officers—Messrs. Alan R. Hawley, President; Henry Woodhouse, Evert Jansen Wendell, Rear Admiral Robert E. Peary, Charles Jerome Edwards and Augustus Post—receiving inquiries and congratulations from leaders of the national preparedness movement, army and navy officers, and people interested in aerial preparedness.

Mr. Alan R. Hawley, President of the Aero Club of America, said:

"The fact that the House of Representatives appropriated $640,000,000 without a single dissenting vote, and that this measure was approved beforehand by President Wilson and Secretary Baker, and by the press of the country, augur well for the next step—that of getting the appropriation necessary to train and equip 10,000 naval aviators, so that major aerial operations against the German fleet and against the U-boat bases can be conducted at the same time as the aerial operations being conducted against the German military centers, ammunition and aircraft factories and railroads.

"The Aero Club of America is writing and wiring its appreciation for this accomplishment to President Wilson, Secretary Baker, Senator Sheppard and Congressman Murray Hulbert, who, by holding hearings on their bill to create a Department of Aeronautics, brought out many facts regarding the importance of aeronautics that would not have been brought out otherwise; Howard E. Coffin, Chairman of the Aircraft Production Board, and Brigadier General George O. Squier.

"The Club also wishes to express its hearty appreciation for the hearty and unanimous support given to this measure by the American press. We have seen hundred of editorials supporting this measure—not a single one against it."

Mr. Henry Woodhouse, a member of the Board of Governors of the Club, and the author of "The Textbook of Naval Aeronautics," speaking of the basic meaning of this appropriation having been granted without delay and without a single dissenting vote, and of its purport, said:

"This country seems, at last, to have come up to the realization of the fact that, as Mr. Andre Tardieu, the French High Commissioner in the United States, has pointed out, 'Time is blood.' A week's delay may mean the loss of tens of thousands of men, and the expenditure of billions of dollars.

"So we must not delay. We must not lose a second in this extremely important work of defeating Germany by striking her through the air, destroying her naval and military bases by aerial attacks.

"Personally, as a member of the generation which must fight this fight, then will have to reconstruct the world, and will have to pay the bills for both the fight and the reconstruction, I realize the importance of not pausing an instant in this important work, and I am thankful that I can give sixteen hours a day to the work of building up our aerial forces, which are to be the most important factor in defeating Germany."

Aeroplanes as Shipping Insurance

Commenting on the statement of Franklin D. Roosevelt, the Asst. Secy. of the Navy, made at Chatauqua several days ago, in which he said: "Ships are being sunk faster than they are being built. We have not found an invention that can take care of submarines," Mr. Alan R. Hawley, President of the Aero Club of America, wrote to Mr. Roosevelt today (July 10), pointing out that aircraft in large number could end the submarine menace.

Mr. Hawley's letter to Mr. Roosevelt reads as follows:

"Hon. Franklin D. Roosevelt,
"Asst. Secretary of the Navy,
"Navy Department,
"Washington, D. C.

"My dear Mr. Roosevelt:

"The members of the Aero Club of America have noted with great interest your address at Chatauqua on July 7th, and especially the following sentences: 'Ships are being sunk faster than they are being built. We have not found an invention that can take care of them,' and 'There is a possibility that we may have an army one year from now, with no means of getting it to Europe.'

"The Aero Club keeps in close touch with happenings in Europe, and has come to the same conclusions as those which you so clearly and forcibly express. As private citizens, however, nothing that we can say carries the conviction to the people that your words carry. You are the Assistant Secretary of the Navy, and have been so for more than four years. All the information that comes to the United States in regard to naval happenings abroad goes, presumably, to you, and you have, furthermore, the advice and assistance of all the experts in the Navy Department.

"As you doubtless are aware, some public men, either from timidity or a misapprehension of the intelligence and character of the American people, fear to tell them unpleasant truths. For this reason, the nation owes you a debt of gratitude for your honest statement. The American people appreciate an official who is not afraid to tell them the truth.

"The fact that the loss in tonnage is increasing from day to day, combined with the fact that the longer it continues the more difficult it will be to send troops to Europe, shows the importance of sending to Europe the most concentrated force we can, because it can be sent in the fewest ships. The force which can be exerted by aeroplane and torpedoplanes is more concentrated than any other kind of force, and, therefore, it can be more easily transported across the ocean. Furthermore, when it arrives in Europe, it can be put to do the thing which is the most urgently required, that is, to eliminate the German submarines. This, as you know, it can do, not only by attacking the submarine itself, but also by attacking battleships and cruisers, without whose support the submarines would be forced to remain in shallow waters. Of course, you realize that the only reason why the Allied small vessels cannot go into the shallow water near the submarine base and attack the submarines there is because the German battleships and cruisers attack them and drive them away. This can best be done by attacking and sinking them by torpedoplanes, which can fly over the mine fields.

"You doubtless have noticed the statement of Mr. A. H. Pollen, the British Naval Expert, that Great Britain cannot stand submarine sinkings at the present rate longer than March 1, 1919, at the latest; and also his statement that it is absolutely necessary for the success of the Allies that the United States help Great Britain eliminate the submarine.

"We are convinced that you could not have made the statements you made at Chatauqua without a profound realization of the responsibility of our Navy Department in this matter. We see a great deal in the public press of the energetic measures which the War Department is taking, but we have not seen any account of what the Navy Department is doing. We think it is the opinion of the people that the Navy Department can do just as much as the War Department to give the Allies the assistance of aeronautics. They seem to think even that the Navy Department can do more; because the submarine is a strictly naval appliance, and its elimination must be accomplished.

"Any information which you can give us, consistently with your duties and responsibilities would be very much appreciated by the Aero Club.

"With sentiments of the highest esteem, I am

"Faithfully yours,
"(Signed) ALAN R. HAWLEY,
"President, Aero Club of America."

Aerial League of America Organized

TO enable the thousands of men, women, boys and girls who are interested in the movement "To Make America First in Aeronautics," but who are not members of any existing aeronautic organizations, to participate in the movement to make America first in aeronautics, the Executive Committee of the Aero Club of America has sanctioned the organization of the *Aerial League of America.*

It is being appreciated that the thousands of enthusiastic men, women, boys and girls who will become members of the Aerial League of America can help tremendously in creating that nation-wide interest and cooperation which is needed to carry out the extensive program of aerial preparedness being undertaken by this country.

As pointed out by Chairman Howard E. Coffin of the Aircraft Production Board, the complete personnel of the Army Air Service will comprise about 150,000 men, there being needed approximately ten mechanics and assistants to each flying officer, not including the instructors and assistants and the administrative personnel.

There will probably be needed as many men for the Naval Air Service when provision is made to organize it on a large scale.

The bulk of this personnel has to be recruited, and one of the purposes of the League will be to encourage enlistment in the Air Service and to increase and diffuse aeronautic knowledge.

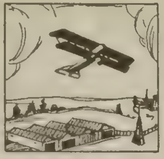
As the element of time in connection with organizing the Air Service is so precious, it is believed that the League will, by spreading aeronautic knowledge throughout the country, succeed in interesting the hundreds of thousands of men of military age, so that when they are selected for the Air Service, they will already have an elementary knowledge of aeronautics—thereby saving invaluable time, and facilitating the work of organizing our air forces.

The officers of the Aerial League of America, elected at the meeting yesterday, are President, Rear Admiral Robert E. Peary, U. S. N.; Vice-Presidents, Alan R. Hawley, Senator Morris Sheppard; Congressman Murray Hulbert, Rear Admiral Bradley A. Fiske, U. S. N.; Brigadier General Robert K. Evans, U. S. A.; Henry Woodhouse; Executive and Treasurer, Augustus Post; Recording Secretary, Bennett E. Tousley.

The Board of Directors includes the above officers and Messrs. John Hays Hammond, Jr., Evert J. Wendell, Senator James H. Brady, Henry A. Wise Wood, W. Earl Dodge, Mrs. William A. Bartlett and Miss Marie A. Peary.

At the first Executive meeting, held yesterday, the following honorary members were elected: President Wilson, Commander in Chief of the Army, Navy and Air Service; Secretary of War Baker, Secretary of the Navy Daniels, Major General John J. Pershing, Commander of the U. S. Forces in France; Vice Admiral Sims, Commander of the U. S. Naval Forces in European waters; Brigadier General George O. Squier, head of the Army Air Service; Howard E. Coffin, Chairman Aircraft Production Board; Rear Admiral David M. Taylor, and Rear Admiral William S. Benson, officers in charge of the Naval Air Service; Lieut. Col. Charles De. F. Chandler, in charge of the Balloon Section of the U. S. Army, and pioneer in military aeronautics; Dr. William F. Durand, Chairman, National Advisory Committee for Aeronautics, Dr. Charles D. Walcott, Chairman, Smithsonian Institution; Mr. Thomas A. Edison, Chairman, Naval Consulting Board; Hon. Byron R. Newton, Asst. Secy. of the Treasury, and head of the Coast Guard; Hon. Charles R. Marshall, Vice-President of the United States and Honorary Chairman of the National Aerial Coast Patrol Commission; Orville Wright, Glenn H. Curtiss, W. Starling Burgess, Alberto Santos-Dumont, President of the Pan-American Aeronautic Federation; Dr. Alexander Graham Bell, Elmer A. Sperry, for his many contributions to the aeronautic movement; Frank A. Sieberling, head of the Goodyear Tire and Rubber Company, for his eight years of continuous support and efforts to develop dirigibles in America; Captain Thomas S. Baldwin, who built the first Army dirigible, for his "forty years of continuous efforts to develop American aeronautics." Col. Theodore Roosevelt is elected an honorary member for "his interest in 1897, when, as Asst. Secy. of the Navy, he recommended to President McKinley that the Government give support to Mr. Langley in his aeronautic experiments; and again, in 1907, when, as President of the United States, he approved the ordering by the Army of the first aeroplane and first dirigible." Emerson McMillan, for his substantial contributions to the cause of aerial preparedness; Mrs. William H. Bliss, for presenting the aeroplanes and the funds for training officers, which resulted in the organization of the First Reserve Aero Squadron; Frank H. Russell, President Aircraft Manufacturers' Association; George W. Dunham, President Society of Automotive Engineers; Charles M. Manly, for his contribution to the work of Langley and his fifteen years of continuous efforts to develop American aeronautics; Miss Katherine Wright, Mrs. Alexander Graham Bell, Miss Ruth Law, Miss Katherine Stinson, Mrs. H. P. Davison, for her efforts in founding Aerial Coast Patrol Unit No. 1; T. Jefferson Coolidge, A. Francis Zahm.

The League has New York offices at 297 Madison Avenue, New York, and in the Union Trust Building, Washington, D. C. There are no initiation fees, and the dues are $5 a year for members, and $2 for junior members, which comprise boys and girls up to 16 years of age.



THE NEWS OF THE WEEK

Players Fly to Baseball Game

Locust Valley, L. I.—Hundreds of persons were on the polo field on the Henry P. Davison estate at Peacock Point, July 14th, to witness the first tussle that has been held in America between baseball enthusiasts representing the aviation branches of the Army and Navy. The Navy won, 3 to 2.

Thirty or more aeroplanes brought the players to the field, where were gathered many notable persons, guests of Mr. and Mrs. Henry P. Davison.

About twenty aviators from the army camp on Hempstead Plains, east of Garden City, flew over to the field and gave exhibitions of squadron and other movements in the air. They had been thoroughly drilled by Captain W. G. Kilner, commander of the Mineola Post, and his assistants.

The navy flyers, with their hydroplanes, landed on the water opposite the Davison estate when they had completed their squadron manoeuvres.

Among the navy flyers were two of Mr. Davison's sons, who are numbered among the original naval flyers.

The objects of the game were to raise funds for the Red Cross and to celebrate the French Day of Independence on the anniversary of the fall of the Bastile.

The aeronautic authorities present included Alan R. Hawley, Rear Admiral Fiske, Evert J. Wendell, Henry Woodhouse, and about forty Naval and Army Reserve aviators.

Lieutenant McDonald was in charge of the Navy men and Captain Kilner and his staff were at the head of the rooters for the Army.

Lieutenant H. H. Salmon, Jr., manager of athletics for the Army, was captain and catcher on his team. Ensign Gould caught for the Navy and assisted Ensign Ames. The teams lined-up as follows:

ARMY	Positions	NAVY
Barrett	Left Field	Smith
Wiefe	Right Field	Landon
Giegler	Centre Field	McIlwaine
Shuch	Short Stop	Ensign Ames
Robertson	First Base	Lynch
Williams	Second Base	Lt. Davison
Woodlief	Third Base	Ensign H. F. Davison, Jr.
Beader	Pitcher	C. S. Reed
Lt. Salmon	Catcher	Ensign Gould

Umpire—Col Robert Thompson (retired), U. S. A.

Quentin Roosevelt Now an Officer in Army Flying Corps

Quentin Roosevelt, son of Colonel Roosevelt, has been commissioned first lieutenant in the First United States Aero Reserve Corps. He is ready for service in France, and will go with the first aerial units.

Lieutenant Roosevelt graduated with honors from the Mineola school along with forty other volunteer aviators. He is now serving under Captain Phillip Carroll.

Board for War Inventors

Washington.—In an effort to mobilize and encourage civilian inventors to devise war machinery for land fighting a board of inventors appointed from civil life by the Secretary of War "to seek, receive, inquire into and assist in the development of inventions, inventive proposals and inventive ideas of possible military value to the United States" is created through the provisions of a bill introduced by Representative George R. Lunn, Democrat, of New York, a member of the Military Affairs Committee.

The bill is aimed at a condition which civilian inventors who in the past have sought the assistance and co-operation of the War Department in connection with military inventions say has discouraged American genius in this direction.

Air Squadron in Long Flight to New Field

Chicago—What is believed to have been the longest squadron flight of army aeroplanes so far was quietly accomplished one day last week.

Twenty-three aeroplanes under Capt. Roy S. Brown, of the Signal Corps, took the air at 6 o'clock in the morning from the aviation field at Ashburn and flew one hour and thirty-five minutes, practically a mile a minute, to Rantoul, near Champagne, Ill.

The trip was made without accident. One plane landed twelve miles from Rantoul for gasoline, but arose with little delay.

The Ashburn camp was abandoned because the government was unable to obtain additional land ceded without paying what is considered too high a price.

Prominent Men in Signal Officers Reserve Corps

Washington.—Announcement was made of prominent Americans who have received commissions in the Signal Officers Reserve Corps. The list includes John J. Carty, chief engineer of the American Telephone and Telegraph Company, the man who perfected the coast to coast telephone service; Frank B. Jewett, chief engineer of the Western Electrical Company; George M. Yorke, vice-president of the Western Union Telegraph Company; Charles R. Forbes, formerly chairman of the Public Utilities Commission; Prof. Hiram Bingham of the Yale faculty, the explorer of the Andes; Louis R. Krumm, chief radio inspector of the Department of Commerce; Sosthenes Behn, president of the Porto Rican American Telegraph Company; R. C. Bolling, solicitor for the United States Steel Corporation, now in France with the American aero squadron; Robert Glendenning, Philadelphia banker; H. B. Hersey, expert of the Weather Bureau; Orville Wright, Thomas S. Baldwin, manufacturer of balloons; Frank C. Page, son of the American Ambassador to Great Britain; Quentin Roosevelt, William A. Larned, former national tennis champion; Seth Low 2d, son of a former Mayor of New York; A. Leo Stevens, balloon manufacturer; J. C. McCoy, copper magnate; Barclay H. Warburton, son-in-law of John Wanamaker; Stephen Holliday Philbin, former Yale halfback, and Thomas Hitchcock of New York.

Landing Place at Long Beach

Brigadier General Squier, commander of the Aviation Department at Washington, has sanctioned the location of an aviation landing station at Long Beach, Long Island.

The Mineola military aviation school is eleven miles from Long Beach, and it is planned to have the officers and students make daily trips to the ocean front and effect landings at the station.

Government Aids Inventor

Washington, D. C.—A favorable report on a resolution providing for a test of a mysterious little machine which its inventor maintains could propel an aeroplane from Washington to European battlefields and back again without carrying fuel was voted last week by the House Patents Committee. T. K. Giragossian, the inventor, says his discovery harnesses at trivial cost an untapped ocean of power.

The committee's resolution would guarantee governmental protection in case he demonstrates the usefulness of his machine to five scientists.

Asks Fliers for France

Washington—Sixteen American fliers will be despatched at once to France to fight in the Lafayette escadrille under the American flag, if a request made to Josephus Daniels, Secretary of the Navy, by Representative Murray Hulbert, democrat, of New York, is granted. Mr. Hulbert called upon the Secretary of the Navy last week and asked him to discharge from the aviation training forces the group of sixteen men who have been training at a naval station in Massachusetts, with the understanding that they will at once go abroad.

Mr. Hulbert said that part of the group had already been examined by representatives in this country of the Lafayette escadrille, and pronounced in trim for active duty. None of them can go abroad, however, until their discharge is received. It was explained to Mr. Daniels by Mr. Hulbert that because of lack of facilities at the naval aviation station the young men cannot make further progress here, and are virtually wasting their time.

"If we had developed our aerial activities in the navy before the war to the extent that prudence seems to have dictated," said Mr. Hulbert, "we would now be prepared to utilize the services of the young men here. Owing to inability to get flying machines the young men, who have completed their preliminary training, will be more useful if they are permitted to go to France, and I hope to obtain their discharges."

Gov. Cox Says U. S. Can Fly to Victory

Fort Benjamin Harrison, Ind.,—Belief that "American men of the air" flying in American aeroplanes will end the war and establish permanent peace, which will be an ample compensation for all sacrifices, was expressed by Gov. Cox of Ohio in an address last week to Onio men trying for commissions in the officers' reserve corps.

"From the facts possessed," said Gov. Cox, "I form the positive belief that American aviators will break into the skyline of Germany like birds in migration—not for the purpose of killing women and children, nor of wreaking human slaughter in any form, but the American birdmen will reach Essen and Kiel and destroy, not only the navy of Germany but every institution which continues the menace of Prussian imperialism. We are not fighting the German people but are seeking to strike down the products of dangerous Prussian leadership."

In concluding Gov. Cox said: "We hope the fortunes of war will be kind to you, and I repeat not only the wish but the conviction that the slaughter of trench warfare is about to end and that peace will come upon this earth through the men of the air."

A group of aviation students at one of the Army training fields.

Lelands Perfecting Plans

Detroit.—Henry M. Leland and son, Wilfred C. Leland, have returned to Detroit following a conference with Government officials in connection with their plans to manufacture aeroplanes for war service. Both are enthusiastic over the progress of details but are not yet prepared to make a definite public announcement. This may be expected in the near future.

The Lelands have both completely resigned from the Cadillac Motor Car Co. Their resignations were not to take effect until July 31, but arrangements were made so that they were enabled to leave the Cadillac plant last week.

Aero Base on Puget Sound

Washington, July 9.—The Navy Department has secured an excellent site for a new aviation station and submarine base on Puget Sound in a tract of land fronting on Port Angeles Harbor, Wash.

A New Company in the Automotive World

A company whose officers and directors are closely affiliated with some of the largest financial interests of Pittsburgh has entered the Automotive field. The activities and developments of this organization will, undoubtedly, be of interest to the entire Automotive industry.

The Iron City Products Company has a broad Pennsylvania charter which grants to it the right to manufacture any article from iron or steel, but it is understood that the initial development will have to do largely with the manufacture and marketing of such parts as have previously met with the most rigid tests, and are identified with the Aircraft, Marine and Automotive industries. The Company is now testing out a number of inventions bearing upon the increased efficiency of automotion and will take up and exploit such of these as meet with their requirements and satisfy all trials in actual operations. The trademark "IPC" will be placed upon such approved articles. The Company has for several months been marketing an improved Piston Ring which will be produced in large quantities in their new factory. This "ICP" ring for pistons is said to incorporate a new engineering principle and has met with a remarkable showing in various tests and received the endorsement of well-known engineers.

Aviation Station at Long Beach

Brigadier General George O. Squier, head of the aviation section of the United States Army, has sanctioned the locating of an aviation landing station at Long Beach, L. I.

The Mineola military aviation school is eleven miles from Long Beach, and it is intended to have the officers and students make daily trips to the ocean front and effect landings at the station. To accommodate the flyers a strip of land at the west end of the beach has been provided and hangar erected.

One of the training machines of the Staten Island School of Aviation in flight.

The Long Beach Home Defence Guard will have charge of the aviation station to protect the property and to prevent trespass or injury to visitors. Captain Frank Coffyn, who is a resident of Long Beach and who has received a commission in the United States Army Aerial Reserve Corps, has attended to the details of obtaining the use of the property from the Long Beach Estates, and beginning next week it is expected that from six to a dozen aeroplanes will make the flight from Mineola and land at the aviation station every day. The officers and students are enthusiastic over the prospect, as it gives them an opportunity to take a swim in the ocean and return to their school after a day's work.—*New York Herald.*

New Aero and Submarine Base

The Navy Department has secured an excellent site for a new aviation station and submarine base on Puget Sound in a tract of land fronting on Port Angeles Harbor, Wash., which has been transferred, by an Executive order recently signed by the President, from the Department of Commerce to the Navy Department. It is expected that the transfer, which is temporary, will later be made permanent by act of Congress.

The tract is a part of the lighthouse reservation on Ediz Hook Spit and lies between the Straight of San Juan de Fuca and Port Angeles Harbor.

U. S. Gets 400 Acres More at Hempstead

Hempstead, N. Y.—The Government has acquired 400 additional acres, making 1,000 in all, for its aviation training field here. It is understood the camp is to be made the finest in America.

Women in Aeroplane Work

Washington.—The war has opened up a new field for women, in some departments of which their work is so superior to men's that they will soon have a monopoly. Women have been found to excel in making the wings and wing surfaces of aeroplanes and with this country pledged to build immense fleets of aircraft, their work will be vitally important in winning the war. At the Plainfield, N. J., plant of the Standard Aero Corporation, which obtained a large war order of aeroplanes for the Government, more than 60 per cent. of the employees making wings are women. Harry Bowers Mingle, president, told why his company preferred women for this work.

"Preparing the linen wing surfaces and making the wings," he said, "is light work requiring deft fingers and close application. It is ideal work for women—the very characteristics of their sex make them superior to men.

"Before undertaking the manufacture of aeroplanes in large quantities such as the Government demands, we thoroughly investigated the question of labor. We found that women were extensively used in England and France in making wings and that they had proved to be better at this work than men. We soon satisfied ourselves that this was the correct practice and started to employ women for the same class of work. In a very short time we found that the women were better workmen than the men, and will soon be employing 500 of them at our Plainfield plant alone. We found the women to be painstaking and fast in their work, and in addition they are precise, which means much when you are doing the highest grade work.

"Soon we will be employing women in other departments. Our superintendent wants to have at least 35 per cent. of the machine-shop work done by women and will put that many at work as soon as the shops are enlarged. With their light touch and careful manipulation of sensitive machines, women are admirably adapted to much of the light machine work done on aeroplanes and it is probable that we will have thousands working on our aeroplanes before many months. Of course, we have made special accommodations for the women but this slight cost is forgotten in the advantage of employing them."

Aeroplane manufacturers all over the country are employing women and the thousands of aeroplanes that will carry the Stars and Stripes over the battlefields of Europe, will represent the work of the women of this country.

One of the woodworking rooms at the plant of the Standard Aero Corporation at Plainfield.

Army Orders

Major Henry Souther, S.O.R.C., to Hampton, Va., temporary duty. (July 3, War D.)

Capt. Clinton G. Edgar, S.O.R.C., to New York, N. Y., temporary duty connection with aeronautics. (July 3, War D.)

First Lieut. Carl W. Connell, S.O.R.C., report in person to commanding general, S.D., for duty. (July 3, War D.)

First Lieut. Paul Pleiss, S.O.R.C., to duty at Fort Omaha Balloon School, and upon completion to Washington for assignment. (July 3, War D.)

First Lieuts. Samuel B. Eckert and Daniel Buckley, Av. Sec., S.O.R.C., to duty with 4th Aero Squadron, Av. Sec., S.C., Camp Kelly, South San Antonio. (June 18, S.D.)

First Lieut. Bee R. Osborne, 4th Aero Squadron, Av. Sec., S.O.R.C., to Columbus to 1st Aero Squadron, S.C., for duty. (June 18, S.D.)

First Lieut. Henry H. Simons, S.O.R.C., to duty at Aviation School, Mineola, N. Y. (July 5, War D.)

First Lieut. Hamilton Hadley, S.O.R.C., to duty with C.S.O. of Army. (July 5, War D.)

First Lieut. Charles J. Glidden, S.O.R.C., from duty at Balloon School, Fort Omaha, to Washington for temporary duty and then to Boston for duty as aeronautical officer, N.E.D. (July 5, War D.)

Officers of Aviation Section, S.O.R.C., to duty as follows: Capt. H. H. Sands and Lieut. C. H. Baetjer to Mount Clemens, Mich., Aviation School; Capts. C. S. Jackson and Charles A. Morrow to Fairfield, O., Aviation School; Capt. Emmett R. Morrow to report to commanding general, Central Department, for duty as aeronautical supply and disbursing officer. (July 6, War D.)

First Lieut. W. C. Woodward, S.O.R.C., to Mount Clemens, Mich., Aviation School, for duty. (July 6, War D.)

Par. 72, S.O. 142, June 20, War D., relating to 1st Lieuts. C. Thomson and W. C. Woodward, S.O.R.C., revoked. (July 7, War D.)

These officers, now detailed in the Aviation Section, Signal Corps, are rated as junior military aviators: Capts. Thurman H. Bane and Guy L. Gearhart; 1st Lieuts. Claude K. Rhinehardt, Thorne Deuel, Jr., Harvey B. S. Burwell, Warren P. Jernigan, Norman J. Boots, William P. Peebles, Norman W. Peek and John E. Rossell. (July 6, War D.)

Capt. Clinton W. Russel, S.C., is designated as acting Dept. aeronautical officer, Panama Canal Department. (July 3, War D.)

First Lieut. Frank M. Kennedy, S.C., to Fort Omaha, Neb., Balloon School for duty. (July 5, War D.)

Capt. Roy S. Brown, Jr. Mil. Av., S.C., and 1st Lieut. William B. Peebles, Cav., to Dayton, O., Aviation School for duty. (July 6, War D.)

The resignation by Capt. W. S. Burgess, Av. Sec., S.O.R.C., is accepted. (July 6, War D.)

Capts. Earl L. Canady and James R. Alfonte, Jr. Mil. Avs., S.C., to report to Aviation School, Mount Clemens, Mich., for duty. (July 6, War D.)

Sergt. 1st Class James McFadden, Av. Sec., S.C., to Provisional Aviation School Squadron, Camp Kelly, South San Antonio, for duty. (June 15, S.D.)

Instructor Thomas T. Birt at the Du Pont School of Aviation, Wilmington, Delaware

Aviation Uniform Not "Allowance"

The Chief of Staff has favorably endorsed the draft of a paragraph which is proposed to be added to the Army Regulations (Par. 1167½) authorizing the issue to aviation officers on memorandum receipt of the heavy clothing, gauntlets and headgear which made up their distinctive uniform while engaged in flights. When the question was submitted to the Judge Advocate General he gave it as his opinion that the issue could be lawfully made on authority "of administrative regulation." General Crowder added the following interesting comment on the general subject of "allowances": "Especial and very strictly construed statutes of the United States inhibit any increase in allowances to officers without the direct authority from Congress. The technical meaning of the word 'allowance' as used in these statutes is, 'a reward for services in money or material * * *.' The issue of clothing has quite usually been considered an allowance. On the other hand it has been given as the opinion of this office that permission to officers to use the distinctive military material of the Army exclusively for the purpose of the Government and for no private purpose is not an allowance. The test is said to be: 'That what is given a man as a reward for services or for the primary purpose of his subsistence or advantage as a man is an allowance.' By this test it is not believed that the issue of aerial armor can be construed as an allowance."

Regulations prescribing the uniform to be worn by Army aviators while flying were adopted recently. The coat is of leather, double-breasted, bears two rows of buttons, and is of three-quarter length. It has a leather belt at the waist, side pockets of the bellows type, one breast pocket and plain leather shoulder straps to which insignia may be attached. A removable fleece wool lining makes it adaptable for summer or winter wear. The trousers also are of leather, the legs so slit as to be wound tightly about the calves. They also have a removable lining for warmth. The helmet is of soft leather, entirely covering the head except for the face-opening. A special make of mask with goggles is provided. Hunting style shoes and gauntlet gloves complete the equipment.

Inquiry developed the fact that the Quartermaster Corps has no available appropriation for the purchase of this uniform and that no estimate for such expenditure was included in the Army estimates for the fiscal year 1918. A special appropriation may be asked to provide the equipment and to reimburse those officers who have purchased such uniforms at their own expense.

New Unbreakable Goggle

There has recently been brought out, by Straus & Buegeleisen, of 37 Warren Street, New York, a goggle that seems to be a distinct advance over those now in use. Somewhat similar to those in use by the Allied aviators in Europe, it has several improvements. It is composed of two layers of glass with a layer of celluloid between, welded together under enormous pressure. This has the effect of making it as transparent as ordinary glass, and in addition is more resting to the eyes. A distinct improvement over previous types of glass goggles is the fact that these goggles,—"RESISTAL," they are called, are bent for vision on the side, giving the wearer a greater range of sight than is the case with straight glass goggles. Another advantage is that the layer of celluloid between the two pieces of glass acts as an insulator, and prevents moisture from gathering on the lens. Numerous strength tests of RESISTAL goggles have been made, and it has been found that even a heavy blow with a hammer will only crack them, and will not shatter them, preventing flying pieces of glass from getting into the wearer's eyes.

To Approve Curtiss Toledo Factory Plans

Toledo, O., July 10.—Plans for Toledo's aeroplane factory will be approved Thursday at a meeting of directors of the Curtiss Aeroplane Company. The meeting is to be held in the office of C. M. Keys, 60 Broadway, New York. The plans for the big aeroplane plant to be erected in West Toledo have been completed by Mills, Rhines, Bellman & Nordhoff and now await the approval of the directors. It is probable that the ground will be broken immediately.

Overland engineers have been studying one of the English types of aeroplane engines which was installed at the Willys-Overland factory last Saturday. Special machinery for the manufacture of parts of the engine will be installed to take care of the work.

Army and Navy News

A Radio Division of the Office of the Chief Signal Officer has been established to handle radio matters for both the Aviation Section and the Signal Corps proper. Major Nugent H. Slaughter, U.S.R., is designated as Officer in Charge of this Division. The Division will be located at 1710 Pennsylvania Avenue.

Captain Charles C. Culver is transferred from the Aircraft Engineering Division to the Radio Division.

Twenty-three aeroplanes from the Ashburn field, near Chicago, flew to the Chanute field, Rantoul, Ill. The 10th aero squadron is located at Rantoul for the future, together with an aviation school squadron. The first flight over the field took place upon arrival of the squadron.

A number of Reserve officers are receiving instruction as Acting Supply Officers of Squadrons. Cross country flying work is scheduled for three days a week and night flying for two days. Varied instruction is being given enlisted men. Consecutive classes are receiving instruction as chiefs of section. Schools are also being conducted in motor overhauling and repair, magnetos, carburetors. A sufficient number are also being taught the duties of sergeant-major. Satisfactory progress is being made in the school for supply sergeants, disbursing clerks, storekeepers and assistants, and record clerks. A school for mess sergeants and cooks has been established and both theoretical and practical instruction given.

Members of the faculty, together with the wireless experts on duty here, have devoted considerable time to experiments with a new apparatus. Up to date results have slightly exceeded the world's record for sending and receiving, both in altitude and distance. The results, however, are not up to the mark set by the designer.

Aviators Arrive at Selfridge Field

Mt. Clemens, Mich.—Two units of the aerial service, the eighth and ninth squadrons of the signal corps, arrived at Selfridge Field from San Antonio, Tex., recently. These units, comprising 400 men, contain flying instructors, wireless operators, mechanics and all workers necessary in a flying camp. Technical work preparatory to the reception of the aviation cadets started yesterday morning. Additional army units for guard duty and for aviation service will arrive here shortly. It is expected that by August 1 the hangars, mess halls, barracks and countless other structures will have been painted and pavements will have been laid to do service as streets. Among the jobs nearing completion at the field is the construction of twelve hangars for aeroplanes, six barracks with a capacity for 150 men each, aerial repair shops, machine shops, truck garages, quartermaster's supply building, school building with six class rooms, hospital, officers' club, twelve mess halls and six buildings to quarter the commissioned officers and four to quarter the non-commissioned officers, administration building, blacksmith shop, water supply plant, power plant and fire protection plant. The hangars are 120 ft. long and have full width sliding doors, 66 ft., at each end to allow for the entrance and exit of aeroplanes.

New Ground School for Aviators

The John Hopkins University has been selected by the War Department as one of eight institutions throughout the country in which schools of military aeronautics are to be established.

For some time negotiations have been going on concerning the selection of Johns Hopkins as one of the instruction centers, and it is understood that several other universities were also anxious to secure the approval of the Government. The exceptional qualifications of the technical faculty of the local institution, coupled with its obvious advantages in the matter of location, finally turned the tide in its favor.

Dr. J. B. Whitehead of the University's mechanical engineering department has been asked to be the director of the school of aeronautics, and if he can arrange his other work so as to make the new position fit in he will accept. The faculty of the aviation school will be largely chosen from the technical faculty of the Hopkins, but several instructors will be detailed by the Government, including a captain and a non-commissioned officer, to give military instruction.

Davenport School in Full Operation

The formal opening of the Davenport Aviation School, which will have seven machines in the air within a month, took place July 4th on Suburban island, when the new military tractor, just completed from specifications furnished by the United States Government, made its first flight.

The new aero-tractor, which will be christened King Boreas, has a speed of 90 miles an hour. The school's flying boat, now in service, has a speed almost as great. New, high-powered motors for the five flying machines now under construction have arrived and all will be ready for service on or about August 1.

The Davenport Aviation school now has two dozen students and applications have been received from 500 others who desire to learn how to build and fly tractors and hydroplanes and to apply the training in the service of their country.

Caro, Mich.—Officers of the Great Lakes Aeroplane Company were elected last week as follows: Directors, L. G. Seeley, W. J. Moore, F. A. Luthey, Clark Daugherty and Fred Hosp; president and general manager, F. A. Luthey; vice-president, W. J. Moore; treasurer, L. G. Seeley; secretary, Clark Daugherty.

Two interested readers of Aerial Age on the Pacific Coast—instructor and student of the Riverside Aviation School.

CONDITIONS RELATIVE TO ENROLLMENT IN THE U. S. NAVAL RESERVE FLYING CORPS IS EXPLAINED IN A CIRCULAR ISSUED BY THE NAVY DEPARTMENT

The Navy Department has issued the following circular of information relative to enrollment in the United States Naval Reserve Flying Corps:

1. Requirements for commission in the Naval Reserve Flying Corps are: American citizenship; physical requirements similar to those for Naval Flying Corps; proficiency in actual operation and care of aircraft; recommendations from three reputable citizens. Educational qualifications will be given special consideration in selecting applicants for enrollment..

2. Requirements for training for commission in the Naval Reserve Flying Corps are: American citizenship; physical requirements similar to those for the Naval Flying Corps; recommendations from three reputable citizens. Educational qualifications will be given special consideration in selecting applicants for enrollment.

3. Blanks for application for commission, or for training for commission, will be furnished upon request addressed to the supervisor, Naval Reserve Flying Corps, Bureau of Navigation, Navy Department, Washington, D. C. After application has been returned to the supervisor with entries made and required letters of recommendation appended, the applicant is notified of the approval or disapproval of his application. If approved, he is directed to report at the designated place for examination and, if found qualified, is there enrolled. He is thereafter subject to call to active duty at any time during the war. During peace he shall at any time be discharged at his own request, or by proper authority. After enrollment and while awaiting call to active duty he performs no naval duty.

4. If enrollment is for training for commission, the enrollment is made as seaman second class in class 4 of the Naval Reserve. Upon completion of the training period, the man so enrolled is examined and if found qualified is transferred to class 5, the Naval Reserve Flying Corps, and is commissioned.

5. All first commissioning is provisional and is subject to confirmation, upon examination, after not less than three months of active duty.

6. Enrollment as a mechanic in the Naval Reserve Flying Corps is by application to the commandant of the naval district in which the applicant resides. District headquarters are as follows:

First naval district, United States Navy Yard, Boston, Mass.

Second naval district, United States Naval Station, Newport, R. I.

Third naval district, United States Navy Yard, New York, N. Y.

Fourth naval district, United States Navy Yard, Philadelphia, Pa.

Fifth naval district, Citizens' Bank Building, Norfolk, Va.

Sixth naval district, United States Navy Recruiting Station, Charleston, S. C.

Seventh naval district, United States Naval Station, Key West, Fla.

Eighth naval district, United States Navy Yard, New Orleans, La.

Ninth, tenth, and eleventh naval districts, United States Naval Station, Great Lakes, Illinois.

Twelfth naval district, 417 Sheldon Building, San Francisco, Cal.

Thirteenth naval district, United States Navy Yard, Puget Sound, Wash.

7. The total number at present to be so enrolled is limited. If accepted and enrolled the applicant performs no naval duty until ordered to active duty. He is in war liable to be ordered at any time after enrollment. In time of peace he shall be discharged at any time at his own request or by proper authority. The applicant should state his age and give his qualifications and experience in full. Requirements in general are: American citizenship, previous experience as aeronautic mechanic or in allied skilled trades, and reputable character.

8. **Pay and allowances.**—The act of Congress approved August 29, 1916, provides as follows:

All members of the Naval Reserve Force shall, when actively employed as set forth in this act, be entitled to the same pay, allowances, gratuities, and other emoluments as officers and enlisted men of the naval service on active duty of corresponding rank or rating and of the same length of service. When not actively employed in the Navy, members of the Naval Reserve Force shall not be entitled to any pay, bounty, gratuity, or pension except as expressly provided for members of the Naval Reserve Force by the provisions of this act.

Members of the Naval Reserve Force shall, upon first reporting for active service for training during each period of enrollment, be credited with a uniform gratuity of $50 for officers and of $30 for men.

FORM OF APPLICATION FOR THE COAST DEFENSE RESERVE CORPS OF THE NAVY

——— ———,
(Present address.)
———, 19—.

To the Bureau of Navigation,
Navy Department,
Washington, D. C.

Sir: I have the honor to apply for enrollment in Naval Coast Defense Reserve, with a view to subsequent training for qualification and duty in the Naval Reserve Flying Corps, as organized under the authority of Congress.

I desire to qualify, if possible, as a commissioned officer.

My name is ——— ———.
(Name in full.)

My age is ——, my height ——, my weight ——, color ——.

I was born ———, 19—, at ——— ———, and am [1]—— a citizen of the United States.

I have served ——— years in [2]——— ———.

I have pursued a regular course of instruction for ——— years in [3]——— ———.

I graduated in the year 19— from [3]——— ———.

My business is ——— ———.

I have received technical training in [5]——— ———.

I have had practical experience in [6]——— ———.

Have you applied for any other duty in naval or military forces? If so, state result and circumstances.

With what foreign languages are you familiar? State in full.

What forms of athletic exercise do you keep up at present?

When in school or college were you a member of any athletic team? If so, in what year and what position did you occupy?

Can you drive a motor car, make minor repairs and adjustments?

Can you ride a motorcycle, make minor repairs and adjustments?

Have you ridden horseback to any extent?

Can you sail a boat?

Have you undergone any course of military instruction? State fully.

To what extent do you use intoxicants?

Have you ever been dismissed from any kind of employment on account of misconduct or inability? If so, state circumstances.

If you have not college training, what qualifications, if any, do you consider you possess which are equivalent to such training? (Educational qualifications are given special consideration.)

I certify on honor that the foregoing statements are true and complete to the best of my knowledge and belief.

Candidate for commission, N. R. F. C.

I inclose three letters of recommendation from prescribed sources, as folls:[7]

——— ———,
——— ———,
——— ———.

Respectfully,

——— ———.

Permanent post-office address ——— ———.

[1] Insert "not" if in accordance with fact.

[2] Insert service in Regular Army, Navy, volunteer forces, Organized Militia, or reserve forces. State in what capacity.

[3] State name and locality of educational institutions.

[5] State any branch of technical training received and extent of this training.

[6] State branches in which you have had practial experience, giving extent of this experience, particularly as to the following: Aviation (flying), gasoline engines, seamanship, navigation, engineering (civil, mechanical, marine, etc.), and the various trades, such as carpenter, machinist, blacksmith, etc.

[7] Application for enrollment must be accompanied by three letters of recommendation from reputable citizens.

State preference, heavier-than-air-craft or dirigibles.

The hangars and barracks at the Du Pont Aviation School, with student airmen. From left to right: R. J. Hopkins, H. A. Jones, R. Talbot, H. Reed, W. H. Bard, Harry N. Atwood, Manager of the School; Thomas T. Birt, Instructor; T. Colleton, E. K. McTernan, F. H. Gouverneur, R. P. Brewer, J. Rathwell, R. Lonaberger. Sitting is the mascot of the school, "Turkey."

AIRCRAFT MANUFACTURERS' ASSOCIATION AND AIRCRAFT PRODUCTION BOARD IN JOINT SESSION

By BENJ. J. WILLIAMS

The Aircraft Manufacturers' Association held a three days' meeting on July 10th, 11th and 12th at the Old Colony Club, Hotel Raleigh, Washington, D. C., which will be the headquarters of the Association for the period of the war because the Aircraft Production Board wishes to keep in the closest touch with the Aircraft Manufacturers' Association until the gigantic problems of producing enough aircraft to make America first in aeronautics have been solved.

All the members of the A. M. A. were present and all phases of the manufacture of aircraft were discussed and considered. Mr. Howard E. Coffin, Mr. Sidney D. Waldon and Mr. E. A. Deeds, of the Aircraft Production Board, also attended the meeting, and Mr. Coffin, the Chairman, devoted one whole afternoon to a lengthy and detailed report of the plans and the objects of the Government organization to place the United States first in aeronautics. At the conclusion of that conference, the A. M. A. passed a resolution expressing absolute confidence in the Aircraft Production Board's program, which will give the broadest latitude to the manufacturers of aircraft in the production of the aircraft necessary to place America in the front ranks in aviation where she rightfully belongs.

Quantity production in all its ramifications was discussed and analyzed at the meeting and every instrument or means to aid the aircraft manufacturers in gaining the maximum efficiency was considered. The facilities of all the individual manufacturing aircraft plants from the smallest to the largest were inventoried and their particularly advantageous facilities were catalogued.

A report from the S. A. E. Committee on the standardization indicated that it was the consensus of their opinion that the Aircraft Manufacturers' Association was better able to handle the technical side of the standardization of aeroplanes and aircraft motors.

In order to expedite and to co-operate in the work, the A. M. A. was given representation on the Committee on Standards of the Standard Division of the S. A. E., which will consider all questions of that nature. In this way the expert talent of the Aircraft Manufacturers' Association will be in close touch with the S. A. E. This represents a very considerable amount of work since the development of the manufacture of aircraft is to be upon such a gigantic scale.

That the aircraft manufacturers, with the aid of branching industries, is competent to meet the requirements of the ambitious program of the Aircraft Production Board for quantity production is now evident.

In order to show that each worker in the aircraft manufacturing industry is doing his bit for his country in this great war, it was decided to have issued to each employee a button which indicated that he is in the service of the aircraft manufacturers.

The A. M. A. is co-operating on an extensive plan with the Automotive Transport Committee of the Council of National Defence of which Mr. K. W. Zimmerschied is Vice-Chairman. President F. H. Russell is also a member of this same Committee.

Perhaps no organized body is co-operating as closely with our Allies as the A. M. A. By means of their continual correspondence with the British Society of Aircraft Constructors, the Association is most intimately acquainted with every new development in aeronautics in Britain and on her far flung battle line. Considering the rapid evolution of aircraft and the daily improvements necessitated by the war, this connection is of most vital interest not only to the aircraft manufacturers but to the part the United States is to play in the great war. This close co-operation between the A. M. A., the S. A. E., the Aircraft Production Board, and the British Aircraft Constructors, ought to do much to establish America supreme in aeronautics.

It is the object of the A. M. A. to be so inclusive as to have enrolled in its membership all the manufacturers of aircraft. At this meeting the Dayton Wright Aeroplane Company, of Dayton, Ohio, and the Wright-Martin Aircraft Corp., of New Brunswick, N. J., and the General Vehicle Co., of Long Island City, N. Y., were admitted as members.

The officers present were: President Frank H. Russell, Marblehead, Mass.; Vice-President A. H. Flint, College Point, N. Y.; Treasurer I. M. Uppercu, New York; Secretary B. L. Williams, New York.

The Aircraft Production Board in its meeting room in the Munsey Building, Washington, D. C. From left to right: A. G. Cable, Secretary of the Board; R. L. Montgomery, Sidney D. Waldon, E. A. Deeds, Rear Admiral David W. Taylor, Chief of the Bureau of Construction and Repair, U. S. N.; Brigadier General George O. Squier, Chief Signal Officer, U. S. A.; Howard E. Coffin, Chairman of the Board.

NOTES ON THE TRUING OF AEROPLANES

By "Alpha" in *The Aeroplane*

THE truing of an aeroplane is a matter more of common sense than mystery, but it must be borne in mind that care and accuracy are absolutely essential. Different types of aeroplanes necessitate different methods of truing, but they are all based on fundamental lines which will be explained in this article.

The first point to come under consideration is the truing of the body of the machine. In the "pusher" type of aeroplane the body is generally rectangular for the greater part of its length, while that of the "tractor" is longer and tapers off towards the tail. The "pusher" body is usually in one piece, and the "tractor" body is often built in two portions, one which contains the engine bearers and the pilot's and observer's seats, and the other which forms the tail. The adjustment of the "pusher" body does not present any difficulty.

Fig. 1 shows the skeleton of a body of the Maurice Farman type. It will be seen from the diagram that all the bays in the structure form rectangles, and it is obvious that if the diagonals are equal, the rectangle being measured is true. The method of truing such a body is: first ensure that it is horizontal both longitudinally and transversely. The lengths of the struts and the spacing of the strut sockets should be checked.

Points should be taken at the tops and bottom of the struts as shown by A. B, C, D in the illustration. The points must be on the center line of the struts and preferably equidistant from the center line of the body, although the top points need not be equally distant from the center line to the bottom points, providing the two points at the top of each bay have the same relative position, and likewise the two bottom points.

It is best to mark these points where possible, on bolt heads or some other metal part, so as to prevent damage to the wood. It only remains now to cross-trammel each bay in turn, i. e., A C must be equal to B D. The cross bracings in the floor, as shown by the plan, are trued in a similar manner.

The tractor body is a much more complicated affair. Each portion—when it is built in two parts—is trued separately. The front part is trued in the way just described for the pusher, when its shape is rectangular. In the tail part a line is attached to a point at the bottom of the last strut, shown at A in Fig. 2. The distance from B to A is measured, and that distance is then marked off in the strut at the other end of the structure (shown C, D).

The top longitudinal, C B, is horizontal, while A E is at an angle to it in this case. The other end of the line is now made fast at D. It can be seen that all points on the line A D are equidistant from the center line of the top longitudinal.

Where the line crosses the center line of the struts a very small hole is punched and similar holes are made where the center lines of the struts cut the center lines of the top longitudinal. We have now a series of rectangles: A B F G, F G H I, etc. Each rectangle is taken in turn, and is trammeled, and the bracing wires are adjusted till the diagonals of the rectangle are equal. Care must be taken that when one bracing wire is tightened, the other in the same bay is slackened off an equal amount, otherwise the struts will be bowed.

When it comes to the trammeling of the top and bottom bays (shown in the plan), points are taken on each transverse strut, or on the longitudinals, e.g., A B C D. It is not necessary to have rectangles, because the longitudinals are at an equal angle to the center line of the body and the diagonals A C and B D will therefore be equal.

The figure made by the end view of the body is already rectangular, and the interval cross bracing is therefore easily checked when the necessary points for trammeling are marked off on the struts. In the front portion where the ends taper, as in Fig. 2, each bay must be marked as shown by J K L M, and then trammeled. Bay N O P Q presents a difficulty owing to the fact that it contains a diagonal strut, Q R. To get over this a plumb line is dropped from Q, and a point is marked on the bottom longitudinal at P; a corresponding point is now marked on the strut N O at O, and this gives the rectangle desired. When both portions of the body are secured together, the center lines of the two parts will form one line.

If a body such as the one in Fig. 2 is taken as an example, it will be true in an horizontal direction when the top longitudinals are in a straight line. The best way to do this would be to get one portion—say the front—horizontal, and then bring the tail portion level with it, checking it by means of a spirit level on a long wooden straightedge—the straightedge would lie equally along the longitudinals of both portions. To check the body for alignment in a transverse direction, attach two rods, S T and X Y, Fig. 2 plan, of equal length, at about the positions shown, the ends of the rods being equidistant from the centre line of the body.

Stretch lines to join S X and T Y, then any pair of measurements such as P Q and V W, if respectively equal, would prove that the whole structure was in line. Any faults in the alignment would have to be remedied at the points where the ends of the longitudinals were joined together.

For example, if the point B (side elevation) was above the horizontal line, the bottom longitudinals would have to be shortened slightly at the ends. If it was below, the top ones would require cutting away. Great care must be exercised if any cutting away is necessary, because, although material can be cut off, *it cannot be replaced.*

The truing of the assembled aeroplane will now be tackled. The machine must first of all be chocked up to the correct flying angle; that is to say, when the aeroplane is level longitudinally and transversely. This is checked by placing a spirit level along the engine bearers and raising or lowering the tail till the bubble is central, and then placing the level on a straightedge across the bearers and chocking up the wheels till the transverse line of the aeroplane is level.

The next step is to brace the wings true with the body, so that corresponding points on each wing will be at equal heights above the horizontal. To measure this a long wooden straightedge is clamped under the body as shown in Fig. 3, and the space between the top of the straightedge and the leading edge of the planes is checked as shown at X and Y.

If these distances are unequal, the adjustment is made on the bracing wires marked E F G H I J and K L. All the wires must be strained equally, otherwise the wings will be bowed. A final check can be taken by measuring the distances A B and A C. A is a point on the top centre portion, and B and C are similar points on the wings.

In some types of aeroplanes there is what is known as a "dihedral" angle; that is, the angle made by the wings to the horizontal plane. The correctness of the angle given to the wings of such an aeroplane is easily verified by stretching a line across the wings between two similar points, O and P, and then measuring the distance D, Fig. 3.

This distance is equal to the sine of the angle made by the wings with the horizontal multiplied by the distance A. P. Adjustments in this case would be made by wires E F, G H, I J, and K L. N. B.—Always start making alterations in the lengths of the straining wires *from the inside bays;* i.e., the bays which contain the wires E F and I J in Fig. 3, and it will be as well to reiterate the injunction that where the diagonal wires in a bay are to be tightened, the opposite wires in the same bay must be slackened off.

This is particularly important in the case of the straining wires between the wings, because the interplane struts are very easily bowed. If a plumb line is dropped down the centre line of a strut, any bowing which has taken place will be quickly perceived.

The distance between the wings, or "gap," is generally shown on "General Arrangement" drawings, so a rough and ready method of checking this dimension on the assembled aeroplane is to cut a rod of wood to size and insert it between the wings. The best place to insert it is near the struts, between the main longitudinal spars of the wings. These spars can be easily felt under the fabric.

Where it is possible, an instrument called a "gap stick" (Fig. 4) should be made. This consists of a length of steel tubing with a plug at one end and a sliding sleeve at the other. There are a set of graduations on the sleeve and another set on the tube.

The graduations on the tube mark distances between the ends A and B, when the centre mark on the sleeve is in line with the pointer P, which slides in a slot in the tube and which can be set to any of the graduations on the tube.

The marks on the sleeve are parts of an inch (32nds for preference), with a centre mark. The method of using the gap stick is as follows: The gap length is taken from the drawing and the pointer is set to correspond.

The stick is introduced between the wings and any difference in the length of the gap will be shown by the centre mark on the sleeve, which will be either above or below the pointer when both ends of the stick are touching the spars.

The only way to obtain the correct gap is to use great care in the fitting of the struts. They should be cut to dead lengths and then fitted *square* into the sockets; there should be no slackness anywhere, and the whole area of the ends of the struts should butt against the pads or the bottoms of the sockets. If this is not done it will mean endless trouble when the aeroplane is assembled.

In aeroplanes in which the wings are "staggered," the method of checking the stagger is to suspend a plumb-line from the top wing and then measure the distance between the string and the leading edge of the bottom plane; this measurement is shown in D, Fig. 5. Alterations to the stagger are made by wires A B and C D; the correct amount is always shown on the general arrangement.

Fig. 5 may also be used to illustrate the angle of incidence of the planes. This angle is shown on the drawing by O. In order to verify the correctness of the incidence given to the planes, an incidence gauge is used; see Fig. 6.

This gauge consists of a straightedge on one end of which is attached a protractor and a spirit level. The gauge is laid along the under-surface of the plane, and the spirit level is moved until the bubble is central. The level, being attached to the protractor, is moved with the latter through the angle necessary to bring the bubble central; this angle is indicated by the pointer, and is equal to the incidence angle given to the wing. If the angle of the plane is incorrect, the adjustment is made by the diagonal wires shown *between* the struts in Fig. 5.

The fixed tail plane is easily levelled by placing a straightedge along the top, and sighting from the straightedge to similar points on the main planes on either side of the body, or by trammeling from the bottom surface of the tail to points on the leading edge of the planes.

The tail plane, however, is fairly small and is rigidly fixed by means of plates or sockets to the tail, and therefore is not very difficult to true up.

In order to make sure that the whole aeroplane is lying true, fore and aft, take measurements from the extremity of the propeller shaft to points on the ends of the wings—see A B and A C, Fig. 7; and from the rudder post to other points on the ends of the wings as shown by the lines D E and D F. Each pair of measurements must be equal. If they are not, make the alterations necessary on wires M N, O P, Q N, and R P.

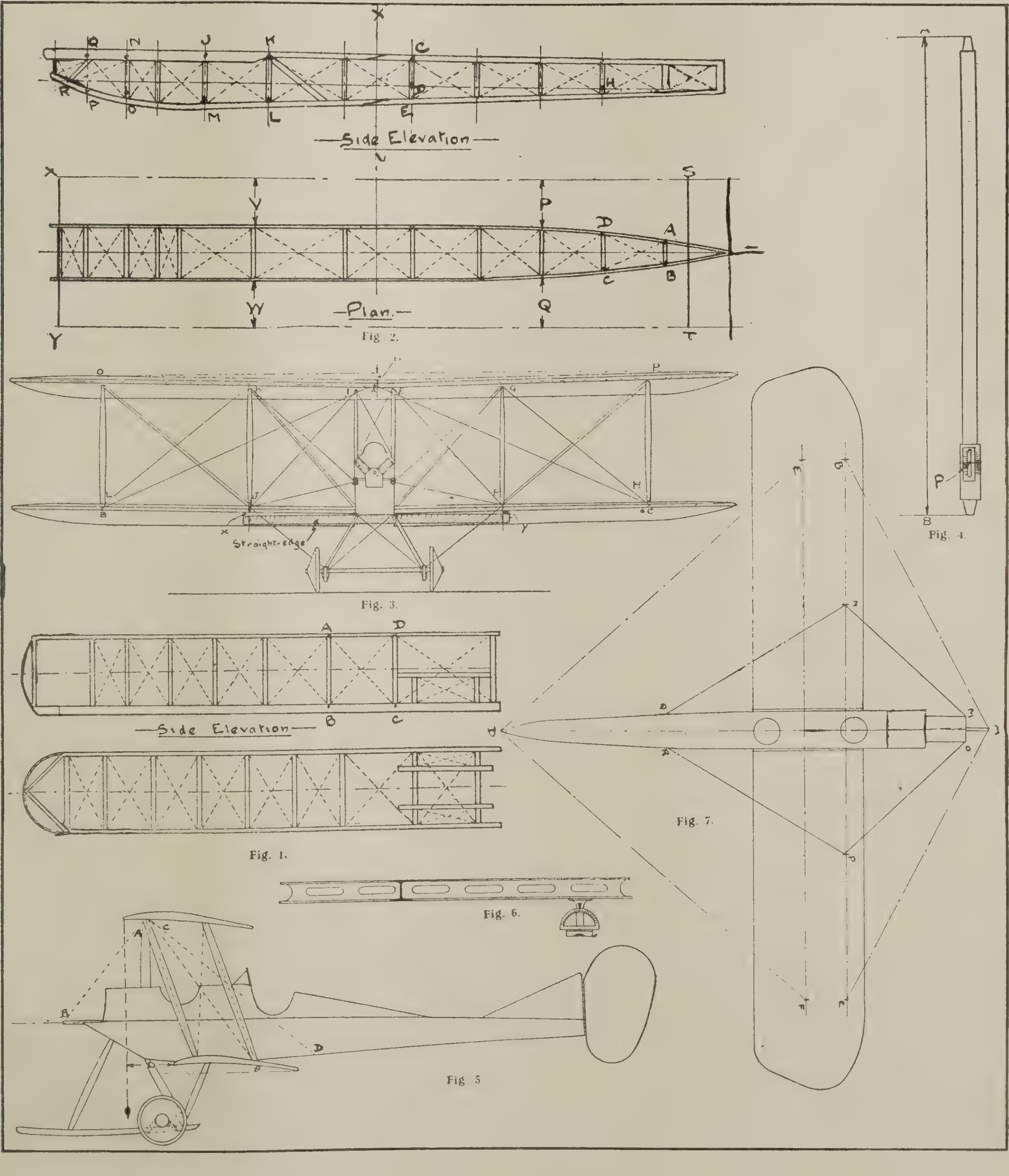


Fig 2.

Fig. 4.

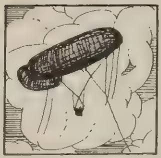
Fig. 3.

Fig. 1.

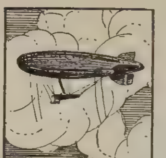
Fig. 7.

Fig. 6.

Fig 5



MILITARY AEROSTATICS



Captain James C. McCoy, U. S. Signal Corps, War Department, Aeronautic Division

Captain James C. McCoy, one of the Charter members of the Aero Club of America, President in 1908, Vice-President and Member of the Board of Governors and of the Contest Committee for many years, is one of the type of sportsmen of which the Aero Club of America is justly proud to have as a member. Captain McCoy was one of the first to take up ballooning in the United States and purchased one of the first aerostats to be used in the international races. He was granted the first Spherical Balloon Pilot Certificate issued by the Aero Club. He accompanied Lieut. Col. Chas. De F. Chandler, U. S. A., when he won the Lahm Trophy, October 17, 1907, in a flight of 20 hours, 15 minutes from St. Louis to Walton, Roane County, W. Va., a distance of 473.56 miles. He competed in the second Gordon Bennett International Balloon Race held at St. Louis, October 21, 1907, placed an order for the best balloon that could be built, to be called "American II," which he used in the Third Gordon Bennett International Balloon Race, held in Berlin, October 11, 1908. He loaned the "American II" to Mr. E. W. Mix, for the fourth international race, starting from Zurich, Switzerland, October 3, 1909. Mr. Mix represented the Aero Club of America and won the race by a voyage of 698.23 miles. The "America II" was also loaned to Mr. Alan R. Hawley, the present president of the Aero Club of America, who won the National Balloon Race, starting from Indianapolis, 1910; and on October 17, 1910, Mr. Hawley, representing the Aero Club of America in the fifth Gordon Bennett International Balloon Race, held at St. Louis, won the race and established a new record, which is still the American distance record, 1172.9 miles. The balloon was left in the Canadian wilderness and brought out over the ice and snow months after the race, repaired and used by Mr. Wm. T. Assmann in the National Balloon Races held in St. Louis the next year, 1911.

Besides being an ardent aeronaut and a skilled balloon pilot, Captain McCoy has made many automobile trips abroad and at home. He is one of the early members of the Automobile Club of America. He is an enthusiastic yachtsman, and turned over his yacht, the "Tanguingui," to the United States Navy at the outbreak of the war. He has travelled around the world many times. Mr. McCoy was one of the first to offer his services to his country and to place his valuable aeronautical knowledge and experience at the command of the Signal Corps and received a commission as a Captain. He also served in the Militia of the State of Colorado, where he held the rank of Colonel.

Rubber in Aircraft

Recently an interesting lecture was delivered to the Aeronautical Society of Great Britain by Captain G. S. Walpole, D.Sc., F.I.C., of the Aeronautical Inspection Department, R.F.C., entitled "The Less Satisfactory Materials of Aircraft Construction."

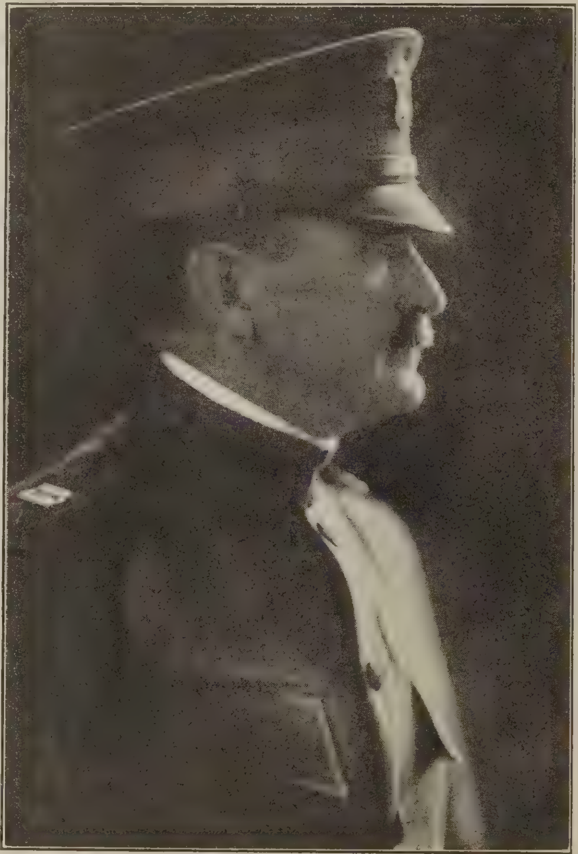
The first material considered was rubber as a shock-absorbing agent. A series of most interesting slides were shown demonstrating tests on Palmer aeroplane tires up to loads of 5 tons per wheel. On the particular wheel in question the spokes collapsed without the tire being affected. He pointed out that there was no object in making the tire lighter, as it had to stand wear and tear on the ground besides direct strain. One particularly interesting picture showed a quite wonderful machine which tests wheels and tires in apparently all directions at once. This photograph also showed a tire evolved by the Palmer Company specifically for use on soft ground.

Referring to shock-absorbers in under-carriages, Dr. Walpole showed how the rubber rings commonly used are stressed in an entirely improper way, and remarked that unfortunately some of them do stand up to the work, and so prolong the use of this arrangement. He described various endeavors to find information as to the actual tensions involved, and pointed out that an ideal shock-absorber should be like a "pudding" which gives to a load and slowly resumes its shape. Steel springs are unsuitable because when loaded they hit back at once. At this point he showed a "Hysteresis Diagram" which is of great interest.

Dr. Walpole admitted that he is not an expert in rubber, but suggested that aircraft designers do not specify what work is required from rubber shock-absorbers, so rubber manufacturers work in the dark. If asked to supply rings for such purposes as those for which they are frequently used, a conscientious manufacturer would refuse to supply them.

Dr. Walpole then discussed the use of rubber piping for conducting liquids about aircraft, and exhibited various specimens of piping which had failed to fulfil its purpose, referring to them very appositely as a kind of "Chamber of Horrors."

On the subject of rubber fabric for balloons, Dr. Walpole told an entertaining story of a "nurse-balloon" at the front which broke away and drifted across the country. Finally the rigging and other tackle was recovered some miles away, but the fabric of the balloon had entirely disappeared—a fact for which the weather did not seem to account. It was noticed, however, later, that the soldiery in the vicinity had acquired a number of nice green water-proof coats.



Capt. James C. McCoy

The Kite Balloon

The kite balloon now used in such large numbers in Europe is a combination of two principles, both long known to aeronautical students —the man-lifting kite and the captive balloon. A strong wind was required to fly the man-lifting kite balloon and an ordinary captive balloon could be flown only in comparative calm. The kite balloon synchronizes the best in both and takes care of either condition.

The purpose of this series of articles is to transfer to the aviation section of our Army and Navy working knowledge of the handling of this type of aircraft.

The apparatus is essentially an elongated balloon which is always kept in an inclined position like a kite. Thus the wind tends to lift it by blowing against the under side. This counteracts the contrary tendency of a wind to blow the balloon over toward the ground.

The outstanding features of the kite balloon are shown in Fig. 1. The shape of the gas bag is modified in such fashion that it has a minimum resistance consistent with other requirements. The steering bag is replaced by an air funnel, C, which is the only inflated protuberance of the balloon. This carries the keel, B, the tail cup, F, and has a value at its lower end through which air enters to make good any deficiency in pressure. In this way a comparatively small hole will supply all the air necessary to keep the balloon well inflated.

The keel, like the funnel, is non-rigid, being supported entirely by a proper balance of forces. Its great advantage over the old steering bag is the fact that it presents a double concave surface to the wind so that it is held in the wind by a positive pressure on both sides at once. In this way any tendency to yaw is stopped almost before it starts. On the other hand, the old type of steering bag will allow considerable deflection or swing of the balloon before its corrective influence is felt. In addition to this the keel has only a small fraction of the resistance of the steering bag, is lighter in weight and is simpler in practical use.

The side fins indicated by A in Fig. 1 are so shaped and disposed that they help in the stability as well as in the kite effect of the balloon.

The function of the tail cups, F, has been reduced almost wholly to one of dampening the motion of the balloon in a gusty wind. Contrary to expectations it was found that the form of construction of the tail cup was a considerable factor in its stability.

The resistance was further cut down by making the balloon more nearly self contained and eliminating superfluous cordage and protuberances.

In other balloons it was found that the gas leakage through the valve and various appendices was commonly many times greater than all other sources of leakage combined. The valve was, therefore, designed especially to prevent leakage. Its size is more than ample for all requirementss of captive or free balloon use. The air valves have also been made tighter and more efficient, thereby cutting down the quantity of air required to keep the balloon properly inflated.

For maximum efficiency the inclination of the balloon to the air must be calculated with considerable exactness. If it is inclined too much, it carries the balloon over and puts an undue strain on the cable. On the other hand if the balloon is too nearly horizontal, the lift of the wind is lost. There is a certain best inclination for each balloon at which it is perfectly steady, the pull on the cable is near a minimum and the altitude a maximum. In order to preserve this proper angle for different conditions of use, the basket is made adjustable so that it can be moved forward or back when necessary. In a thirty-mile wind, there should be no motion apparent in the basket; the cable tension at the balloon should be less than 1,000 pounds and an altitude of 4,000 feet readily attainable.

Aviation School List Cut

Plattsburg, N. Y.—Instead of twenty-five aviators selected last week to go to the ground aviation school at the Massachusetts Institute of Technology, ten men from each camp here will report for instruction next Monday. The delay in detailing men to Cambridge, it is said, is due to the congestion there. The revised list of men who are ordered to Cambridge follows:

New York Regiment—Roy Platon, First Company, 19 Seventy-ninth Street, Brooklyn; A. E. Griffiths, Second Company, 375 Degraw Street, Brooklyn; Arthur L. Tait, Second Company, 434 Riverside Drive, New York; Walter B. Chalaire, Fifth Company, 1,275 Lexington Avenue, New York; Second Lieutenant Edwin Mott, U. S. R., Fifth Company, 344 East Twenty-second Street, Brooklyn; J. R. Dunlap, Jr., Sixth Company, 6 East Thirty-ninth Street, New York; Stephen Bonsal, Jr., Ninth Company, 51 Vanderbilt Avenue, New York; Gerald V. Carroll, Ninth Company, 110 West 183d Street, New York; Louis F. Plummer, Ninth Company, New Rochelle; A. F. Seaver, Ninth Company, 1,038 Eighty-third Street, Brooklyn.

New England Regiment—C. G. Chapin, Fifth Company, Norwichtown, Conn.; Roger W. Rowland, First Company, Springfield, Mass.; H. L. Eddy, Second Company, New Britain, Conn.; Edward F. Hollander, Third Company, Providence, R. I.; A. M. Druary, Fourth Company, Northampton, Mass.; Francis E. Carleton, Fifth Company, Lawrence, Mass.; A. J. Downey, Fifth Company, Boston; J. R. Sanford, Sixth Company, Skowheger, Me.; L. A. Hamilton, Ninth Company, Pittsfield, Mass.; R. A. Bush, Ninth Company, Pittsfield, Mass.

WAR TO BE DECIDED BY AIR SUPREMACY

Discussing the aviation problem of the allied Powers, Capt. de la Grange of the French Aviation Corps, now in this country, expressed his conviction that America's entry with a vast aerial fleet would win the war.

"We realize," he said, "that forces actually now taking part in the gigantic struggle are perceptibly equal. There are about 3,000 allied aeroplanes against the same number of Germans. Imagine what would happen if America suddenly threw in several thousand more aeroplanes in 1918. This would mean that there would be against each German aeroplane two or three allied ones, and if during an attack the Allies concentrated their aerial forces there could be five or six allied machines to one German in the area of the attack.

"The German machines would be obliged to stay behind their lines and would be attacked over their own aerodromes. The allied spotting machines would be able to do their work in absolute security and could therefore direct the firing very accurately and save a great deal of ammunition. The result of all this would be that we would have a great deal of information of all that was being done back of the German lines, while our adversaries would know nothing of what we were preparing.

"The blinding of the enemy and the precision of our artillery fire would have a double advantage—it would save ammunition and also the lives of many of our soldiers. If the front was pierced and the enemy forced to retreat it would be as disastrous to him now as it would have been in the old days for an army to retreat without cavalry in the face of an enemy having a powerful cavalry. The aviation service is the cavalry of modern times.

"The intervention of the United States in 1918 with a great and powerful aviation fleet would without doubt mean victory for the Allies."

Capt. de la Grange, of the French Aeronautic Commission, now in this country.

General Mariani, Italian Minister of War, and his staff, visiting the motor and accessories section of the National Aeronautic Exposition at Milan, Italy.

STARTERS FOR LARGE SIZED AVIATION MOTORS

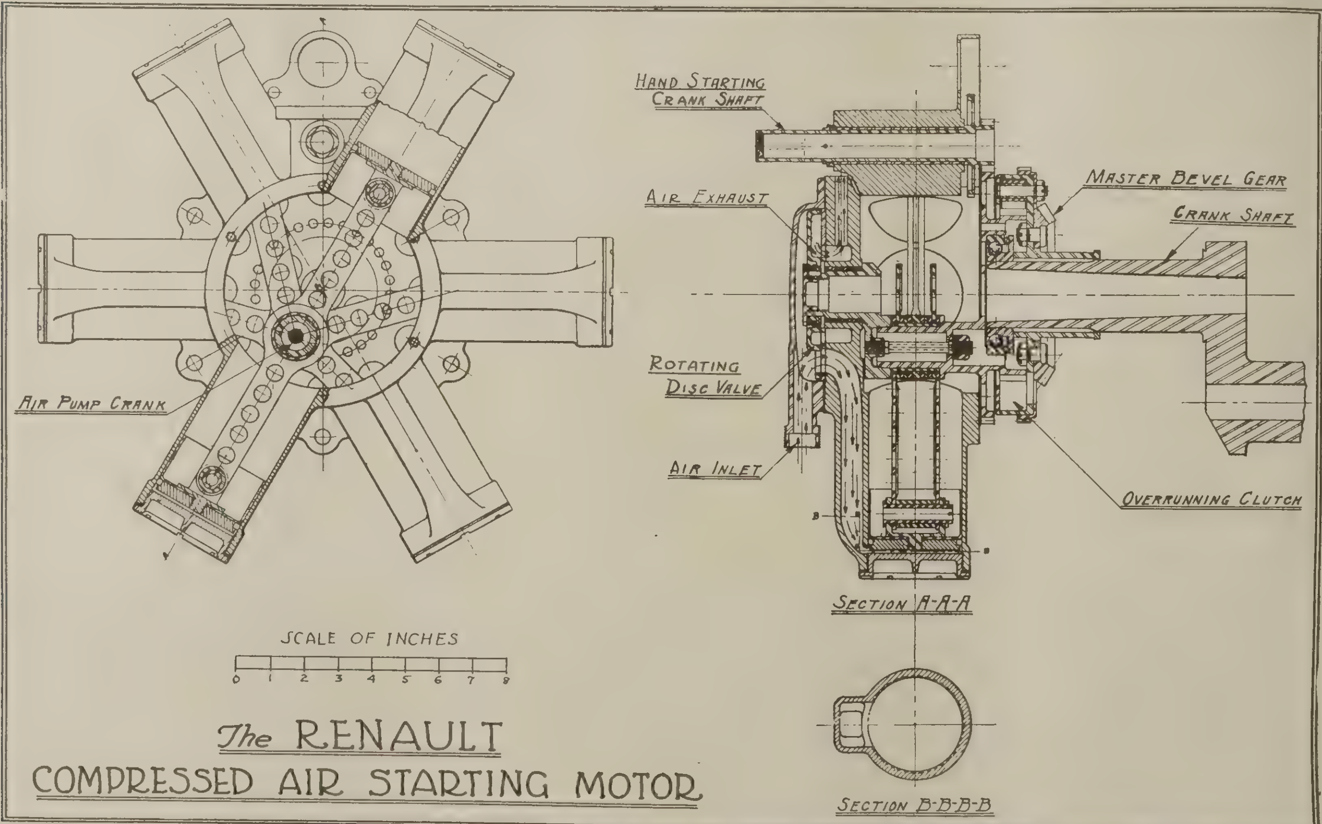
By E. H. Sherbondy

FOR aviation motors of more than 100 horse-power, particularly where the cylinder sizes are more than 4" in diameter, the physical effort required in turning over these engines in starting becomes abnormally large. It has, therefore, been found necessary to arrange some form of starting motor which is both reliable and light in weight. There has as yet been developed only one or two electric starting systems for aviation motors, and the weight of these systems, which includes a generator, battery, switches and wiring, is considerable. No doubt in time satisfactory light weight electric starting units will be developed for aviation motors. However, only a few of the manufacturers of automobile starting and lighting equipment are in a position to supply satisfactory light weight starting and lighting units for aviation motors. There have been one or two air starting systems developed in America by accessories manufacturers for aviation motors. These systems have been developed by accessories manufacturers instead of the motor manufacturers themselves.

In the development of larger European aviation motors it has now become quite standard to fit an air starting system with an air storage bottle. No means are supplied for recharging the air bottle, though this could be readily accomplished by the addition of a small sized air pump to a motor.

The Sunbeam have a built-in air starter on their Twin Six engine which weighs complete only five pounds and seven ounces. This air starting system consists of a pair of distributor valves mounted on the forward end of the exhaust cam shafts, from which air pipes convey the air to starting valves mounted in each cylinder. These starting valves are of the spring loaded pocket type and are pneumatically actuated.

On the Renault Twin Six aviation motor there is built to the front end of the crank case (opposite from the propeller end) a six-cylinder aluminum air starting engine of particularly interesting construction. This starting motor has six cylinders arranged in radial fashion around a single crank pin. The cylinders together with the crank chamber and air passages forms a single casting which is made of aluminum. Integrally built with this air starter is a hand starting gear. The ratio of the hand cranking shaft to the crank shaft speed is 5⅜ to 1. There are absolutely no poppet valves or piping used in connection with this air starter. A single combined rotating disc valve serves as an inlet discharge valve for the air passing to each of the six cylinders. This disc valve is mounted at the front end of the starting motor crank shaft and is held to its seat nominally by means of a light spring. The air pressure on the outside of the valve also serves to keep the valve against its seat. Cranks together with the hand starting gear main clutch member is machined out of one piece of B. N. D. steel and is a very costly but beautiful piece of work. On the extreme end of the motor crank shaft there is mounted a combined annular and thrust bearing which serves as the supporting member for the starting motor crank shaft. Concentric with this bearing there is mounted on the engine crank shaft another unit which comprises an over-running clutch, a master bevel gear from which all the accessories of the engine, such as cam shafts, water pump, oil pump, magnetos and all accessories are driven. There is also constructed integrally with this unit an oil thrower ring to prevent oil from working out of the front end of the crank case. The hub of this over-running clutch member has six keyways cut into it which fit on the blind end of the motor crank shaft. The pistons of the air starting motor are built up of light stamped steel cup shaped pieces, a forked steel piece which serves as the piston pin bosses and an aluminum head piece which is screwed on to a stud formed integrally with the forked steel gudgeon pin carrier. Carried between this aluminum head piece and the cup shaped steel stamping there is a single ring of fibrous material that serves as a packing for these pistons. The connecting rods are formed from two light steel perforated plates. Each of the connecting rods from the six cylinders bear against the hardened steel bushing which is mounted on the crank pin. This bushing is a floating member and is supposed to turn in each of the connecting rods during the exhaust stroke of each of the cylinders. On the inlet or power stroke the pressure on the rods against the bushing prevents the bushing from turning in the connecting rods. This connecting rod big end was used in the Adams-Farwell construction of ten years ago. The crank shaft itself is made in two pieces. The master piece of the crank pin has a tapered turn on it which sockets into the forward crank arm and the two pieces of the shaft are held together by means of a stud and



Figs. 1 and 2 showing the construction of the Renault starting motor.

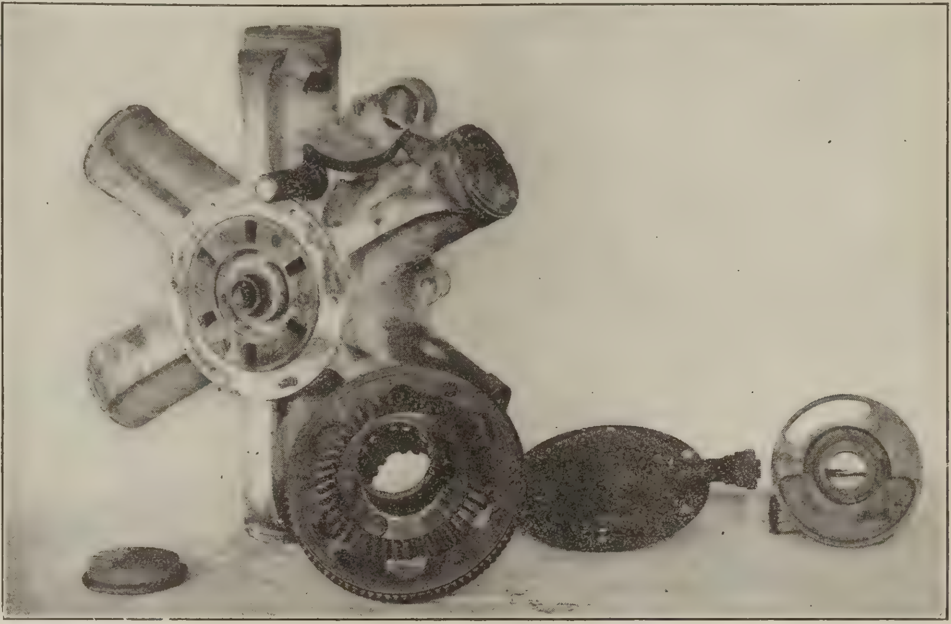


Fig. 3. The front end of the Renault starting motor

nut retention. The short crank arm serves only as a driving member for the rotating disc valve and steadying member to the crank pin.

Drawing 1, Figures 1 and 2, show the construction of the Renault starting motor together with the hand starting gear and over-running clutch.

Figure 3 shows the front end of the starting motor clearly illustrating the air inlet ports. Also, may be seen in this photograph the master driving bevel gear and the air inlet and discharge valve, which is a rotating disc type. In the piece which is shown at the right of the photographs there is a steel cover which is mounted over the rotating disc valve.

Figure 4 shows a rear view of the air starting motor. In the lower part of the photograph may be seen the female member of the overrunning clutch. To the right of the photograph is shown the reverse side of the rotating disc valve and its cover. The small gear which is mounted concentrically with the hand starting pinion shown in this view serves to drive a starting magneto. The total weight of the unit is thirty pounds.

Our Aircraft Fleet

(*Editorial in the New York Herald*)

It is well to keep in mind that the quality production of an air fleet, however large, will not in any way impede the concurrent supply of the other instrumentalities and munitions of war. Great Britain has reached a point where it can turn out 4,000 aeroplanes a month—that is, nearly 50,000 yearly—but, as Alan A. Hawley, president of the Aero Club of America, stated in a communication published on Sunday, "by prompt action and utilizing every minute and every factory that can produce aeroplanes or their parts," we should be able, because of our superior latent resources, to do in 12 months "what it took two years for the British aeronautic industry to do." It would be unprofitable, perhaps unwise, to attempt any enumeration of the ships needed, yet by the end of this year we should have close to 30,000 craft in Europe and ready for the fighting on land and sea. The cost? Well, realizing what torpedo hydroaeroplanes at sea will do for the submarines and what clouds of aeroplanes will achieve in the forefronts of the land, we can well afford to shut our eyes to the cost and give every dollar needed.

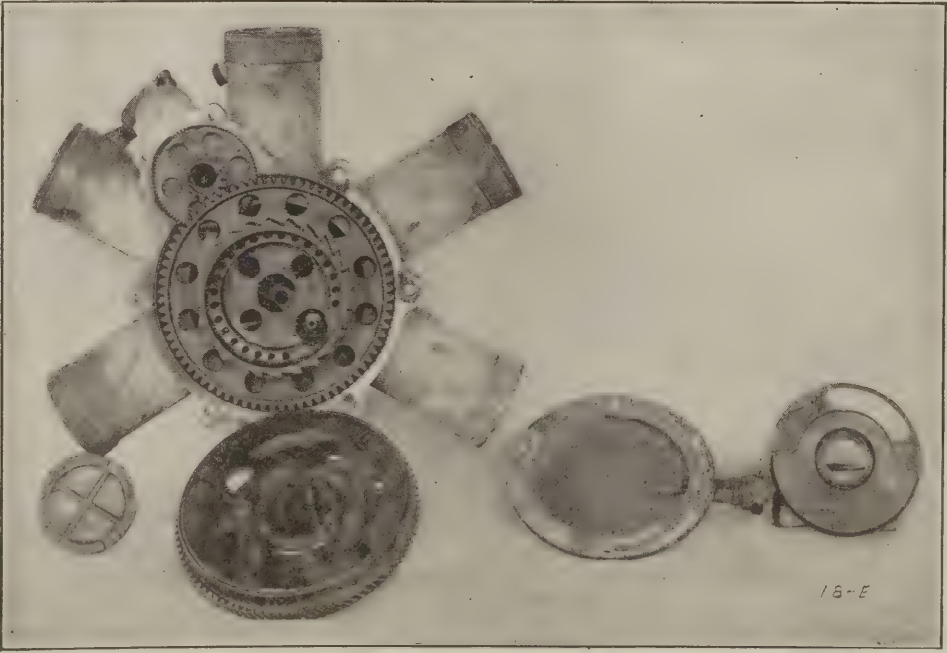


Fig. 4. The rear view of the Renault staring motor.

STEELS USED IN AERO WORK

By DR. W. H. HATFIELD, Brown-Firth Research Laboratory, Sheffield, Eng.

(*Continued from page 529*)

Bending Test—The simple bend test is not appreciated, and is imperfectly understood. It may perhaps be useful to discuss it. If a square bar is bent to a very sharp radius, elastic deformation ceases after a fraction of a degree of deflection. During the plastic deformation there is considerable change of shape of the cross-section of the bar at the plane of severest bending. The outside of the bend, which is elongated, naturally suffers reduction of area, both in width and depth. The inside of the bend, which is compressed longitudinally, receives a "bulging." The diagram shows the shape assumed by a 1 in. square bar of mild steel when bent to 180°, the smallest radius of the inside of the bend being approximately ¼ in. The local elongation of the outside of the bend approaches 100 per cent (reduction of area 50 per cent), decrease of width 29 per cent. The local compression at the inside of the bend is about 25 per cent, with an increase of width of 42 per cent. The surfaces of the bars are no longer plane, the transverse bulging on the inside of the bend being very marked. As bending proceeds, the position of plane of "neutral stress" is displaced towards the inside of the bend. The material which formed the original axis of the bar is, at a later stage, well inside the tension portion of the section.** The angle to which a plain bar can be bent without fracture appears to depend on the ductility of the material. Thus, if the abovementioned bar had only been capable of, say, 25 per cent reduction of area, fracture would have commenced at about 90° of bend. Providing very high tensile material (100 tons) can develop a sufficiently good reduction of area, other things being equal it will bend to 180°.

In Fig. 3 a bending test is illustrated drawn from an actual experiment. On the compression side of the bend several "kinks" will be noted. (The analysis of the material used in the experiment was: Carbon, 0.30 per cent; manganese, 0.58 per cent.) This little test will indicate the intensity of local deformation which can be developed, and it only needs an alternating action to produce early rupture.

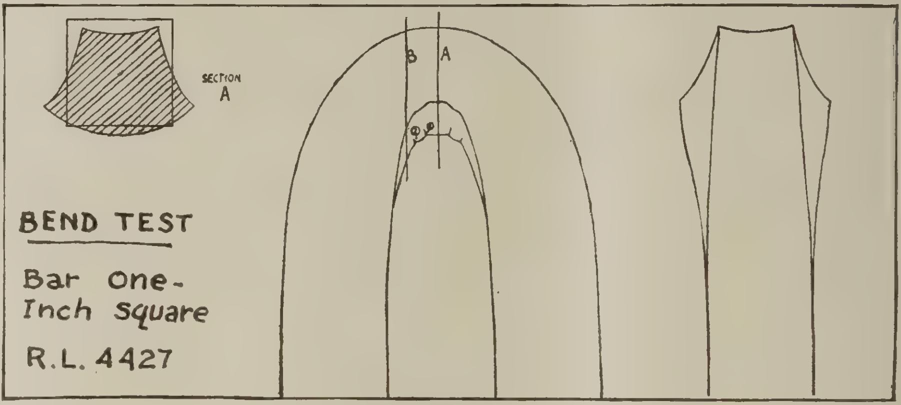


Fig. 3

Impact Test—Impact tests of the Izod and Charpy type were instituted with the object of detecting and measuring brittleness. The relative merits of materials in this respect are supposed to be indicated by the amount of energy absorbed in fracturing notched bars of particular form and dimensions. In the two machines mentioned the fracture is completed by a single blow. These tests have the advantage that they are very simple in operation, and give easily observed values. The justification for their use, however, must lie in the amount of success which they have had in detecting brittleness of a dangerous nature, which was not already known or could not have been easily found from other tests, and of the use which they have been in preventing the employment of unsafe materials. In this respect the genuine usefulness of the tests remains to be demonstrated.

The tests are very sensitive. They give widely-varying results for different materials. Occasionally they give widely-varying results for the same material, and, in fact, for the same test-bar, the fractured sections being less than a couple of inches apart. The variability in the results for the same material, for no *apparent* cause, forms, in my opinion, a serious objection to the test. The possible causes of variation, however, are many. An important cause is inaccuracy in preparation of test-pieces. Extreme care is required to obtain exact dimensions, as slight errors give magnified differences in readings. Even with perfect test-pieces variation is, in my opinion, an unavoidable feature of the test owing to the incidental circumstance as to how the microstructure is situated relative to the bottom of the notch. In the Izod test the condition of the material close to the bottom of the notch is also a vital factor in the test. However, a flaw in the material is not always indicated by a low impact value. It may be the cause of high impact value, as when a crack runs parallel to the notched face. It is, therefore, advisable to examine the piece after fracture for any indications of these flaws, and it seems to me that particulars of impact test results should include description, and, if it were possible, the area of the ruptured piece.

After considering all the facts relating to impact tests on notched bars as at present carried out, I am convinced that too much reliance is often placed on them and a much too ready interpretation placed upon the results. A high value is given by a steel in "good" condition, so I am told. But what, may I ask, is a good condition? From what standpoint is it "good"? Is it because a maximum tempering effect has been obtained?

Examples could be quoted from practice of materials whose tests showed low impact values, but which worked satisfactorily over long periods under severe conditions. Until it is better understood what quality is really indicated by the impact value, and what are the causes of variation, it seems not only unnecessary, but unwise to make too much of it.

A high impact value is usually obtained when the material is capable of absorbing considerable energy by "cold work," and an examination of fractures shows that cold working does not take place uniformly throughout the material, but is confined to relatively small regions. The distribution in the amount of "work" is surprisingly irregular. A severely worked portion may come almost in direct contact with an apparently unworked portion, the two regions being separated by a crack. It is difficult to trace the distribution of stress and strain which give rise to such a condition, but it seems reasonable to expect that when once a crack is formed it should become a surface of discontinuity with regard to subsequent straining. The position of the first crack and the direction in which it afterwards extends must be largely influenced by slight local variations in the physical condition of the material.

In Fig. 4 is a diagram of an impact test-piece of wrought iron which gave an exceptionally high figure without being broken. You will notice the shape of the crack. The well-worked material is only separated by a crack from material which is apparently undeformed.

Hardness Tests—The resistance of material to penetration, as determined by Brinell and Shore tests, gives a convenient check on the quality of the material, and can be readily applied for detecting local differences not indicated by the tensile test. The standard form of the first of these tests involves the determination of the size of permanent impression left after pressing a hard steel ball, of standard size (10 mm.) into a sample of the material at a plane surface, by a stated pressure (3,000 kilograms). The hardness number is taken as the pressure per square millimetre of this spherical area.

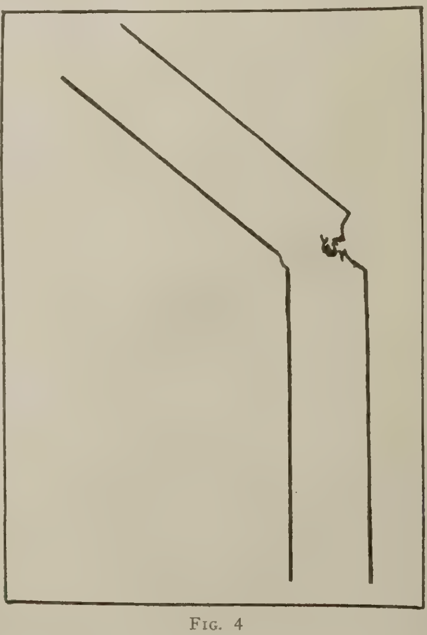


Fig. 4

In the Shore Scleroscope test the height of rebound is measured by a small diamond-tipped hammer falling from a standard height on to a prepared horizontal surface of the material to be tested. The hardness number which is indicated on the scale is proportional to the height of rebound. In this test a permanent impression is left on the face of the material, similar to but on a smaller scale than that of the Brinell. The reading of the machine depends on the ratio of the amount of energy absorbed in elastic deformation to that absorbed in plastic deformation. In distinction to the Brinell test, the actual

The two types of test agree fairly well with each other, and in some ranges with the maximum stress from the tensile test. This general agreement, even in a limited range, is useful in suggesting whether the tensile figures denote a proper test or a premature break due to flaws. When, however, we consider the whole range of mechanical properties in steel, the relation between the two tests and between each test and the tensile is not very rigid. The hardness numbers are not proportional to each other, although the Brinell number and maximum stress agree somewhat in this respect.

It has already been shown that there is very little agreement between hardness as determined by these methods and wear resistance, or machining properties of material, which properties therefore require special tests. Brinell hardness incidentally is not an infallible guide as to machining properties.

When dealing with hardened steels, the Shore is much more reliable than the Brinell, but really only applies to plane surfaces.

Alternating Stresses—The majority of engine parts are subjected to alternating or fluctuating stresses. Many experiments have been made, in extension of the original experiments of Wohler, †† to find the endurance of material under such stresses in direct tension and compression, bending, and torsion. These have shown that the maximum safe stress depends on the range and speed of fluctuation, and have given rise to the approximate rule that by adding the "range" of stress to the stress at the maximum end of the "range" we get an "equivalent steady stress." Any such rule is only approximate, and from the special point of view of the aeroplane designer who wishes to get the best possible service out of the material consistently with safety, it is desirable that repeated stress tests should be made on all materials with which he has to deal which undergo such stresses in working. Such tests, however, would take up much time and attention.

Torsion Test—This form of test seems to me to be of particular interest to aero engineers, and I am rather astonished that more attention has not been given to it in its simple form and many possible modifications.

Any shaft which transmits power suffers "torsion," and the natural method of testing the strength of such a shaft or of the material of which it is made should be by torsion. The amount of "torsion" acting at a section of a shaft or test-piece is the total moment, about the axis, of the forces tending to twist one portion relatively to another at that section.

The stresses due to torsion over a normal section of a cylindrical bar are pure shear. For a

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**A. Martens, "Materialienkunde fur den Maschinenbau."

††Unwin's Testing of Materials.

solid section the shear stress (within elastic limit) is maximum at the skin of the material, and decreases uniformly to the center where it is zero. The range of variation of stress is reduced by making the section hollow.

The stress-strain diagram for the torsion test shows little, if any, "droop" from the maximum twisting moment. This is due to the absence of local contraction as it occurs in the tensile test. The plastic deformation in the torsion test takes place almost uniformly over the length of the parallel portion. The maximum stress is shear for any material is usually about 60-70 per cent of the maximum tensile stress for that material, but the ratio is by no means a fixed quantity; hence the necessity for separate tests.

The total angle of twist to fracture per unit length of test-piece is a good criterion of "ductility" of the material.

The Steels Used in Aero Construction

In giving a paper of this kind it is totally impossible to deal adequately with the different steels that are now being used in this field, and the best that one can do is to take and discuss a few typical ones. For instance, for case-hardening purposes three or four different steels may be used, sometimes a plain low carbon material, at other times say a nickel or a nickel-chrome steel. When we come to consider high-tension steels many people swear by nickel-chrome steel, but under this term "nickel-chrome" quite a large range of analysis is included; again, some people successfully employ chrome-vanadium steels. To consider air-hardening steels, the term "air-hardening" applies to a range of steels, and the only thing to do is to take a typical one as an example. Looking at matters broadly from this standpoint, I have selected a series of steels which, on detailed discussion, will, I think, give an accurate idea of the large range of composition, coupled with the physical and mechanical properties, which are now available for purposes such as the one under discussion. In the following table will be found a list of the steels with which it is proposed to deal, together with their approximate composition:

Steel	Carbon	Manganese	Nickel	Chromium	Vanadium	Tungsten
(1) Case-hardening steel—						
Carbon	0.12	0.7	...	...	...	...
Nickel	0.10	0.2	5.0	...	...	...
(2) Carbon steel...........	0.5	0.6	...	...	...	...
(3) High-tensile steel—						
Nickel-Chrome	0.35	0.4	3.0	0.6	...	...
Chrome Vanadium...	0.35	0.4	...	0.6–1.0	0.16–0.25	...
(4) Air-hardening steel.....	0.3	0.4	4.0	1.5	...	...
(5) Stainless steel.........	0.3	0.4	...	13.0	...	...
(6) High-nickel steel.......	0.25	0.3	25.0	...	...	...
(7) Magnet steel...........	0.6	0.3	...	...	...	5.5
(8) Manganese steel.......	1.2	12.5	...	...	...	...

It will be noted that silicon, sulphur, and phosphorus are not included in the table. With regard to silicon, it is now generally admitted that a fair percentage of this element is an advantage, owing to its utility in deoxidizing and in assisting to produce sound material. When we come to consider sulphur and phosphorus, it is well that I should emphasize that these elements should be as low as circumstances permit.

Before discussing the particular properties of individual steels, it will perhaps be as well to explain the changes taking place at the critical change-points which occur in steel by means of a series of heating and cooling curves, since the thermal phenomena are of such fundamental importance.

Thermal Phenomena of Steels

Pure Iron (*Carbonless*)—If a sample of pure iron be carefully studied it will be found that upon heating the specimen up to a temperature of 1,000° C. two distinct arrests of the otherwise regular rise in temperature will have been noticed. The explanation is that fundamental changes have taken place in the material at those arrests, accompanied by an absorption of heat, *i.e.*, energy required to accomplish the changes referred to. The first arrest at 770° C. marks the appearance of the non-magnetic condition; the second at 930° C. marks an allotropic change in the material, accompanied by change in several properties. On cooling down the arrests are replaced by corresponding evolutions of heat representing converse changes. Pure iron is of little immediate interest to you, and may, therefore, be dismissed after these preliminary comments.

Carbon Steels—If, now, a little carbon be added to iron and, say, a case-hardning steel is produced, the heating and cooling curves become modified. Microscopic inspection showed that only *ferrite* (pure iron) crystals were present in the structure of a carbonless iron, whilst in the structure of a case-hardening steel there was present in small proportion the new dark etching constituent "Pearlite." This pearlite, existing at ordinary temperatures, is a mixture of iron-carbide plates and iron. When a temperature just over 700° C. is reached this constituent changes into a homogeneous substance, *i.e.*, a solid solution of carbide of iron with an absorption of heat resulting in an additional arrest on the heating curve non-existent in the case of pure iron. It will be noticed that the magnetic change still occurs at the same temperature, whilst the allotropic change, Ac3, occurs at a distinctly lower temperature. It may also be pointed out that as the temperature rises after passing the carbon change-point the areas of solid solution increase owing to the solution of more and more ferrite in the original solid solution areas, and finally, in passing the allotropic change, the whole material becomes a homogeneous dilute solid solution of carbide in iron. On cooling, the reverse changes take place at the critical point. On reaching ordinary temperature, providing adequate time for cooling has been allowed, the material is as before the experiment.

To take now a 0.6 carbon steel. The major portion of the material now consists of the constituent pearlite, and thus it might be expected that the carbon change-point becomes still very much more evident and that the other critical points associated with a pure iron are very considerably lowered as regards the temperatures at which they occur. It will be seen that the upper critical points have, for practical purposes, been lowered to and joined up with the carbon change-point. It will be noticed that the absorption of heat, synchronizing with the formation of the solid solution on heating, takes place at about 730° C., whilst on cooling the evolution of heat associated with the breaking down of the solid solution takes place 20° to 30° lower.

Iron-Carbide Diagram—It was thought useful to include the Iron-Carbide Equilibrium Diagram, and this is given in Fig. 1. Its practical application will now be quite apparent. It will be seen to deal with iron containing carbon from nothing to 5.0 per cent, *i.e.*, it covers the range from iron-carbon steels to pig iron, and diagrammatically presents a mass of useful facts. If the *arrests* during cooling of an infinite number of pure iron carbon alloys covering the range of the diagram from 1,600° C., *i.e.*, well in the liquid state, are plotted, the lines presented will be obtained. This is rather an overstatement, since the lines A.D. and I.D. have had to be confirmed by other methods. It is, however, no part of my present paper to discuss the theoretical details of this diagram. There are, however, three main lines to which I wish to draw your attention: (1) The line A-B, indicating that by increasing the carbon content the freezing point is dropped from 1,506° C. for pure iron to 1,137° C. for the eutectic, *i.e.*, pure pig iron. This is the explanation of the low melting point of the cast irons. (2) The E-G-I indicating that the solid solution (single constituent) persists to progressively lower temperatures until the material contains 0.9 per cent of carbon. The case-hardening and carbon steels recently dealt with may be considered from this standpoint. (3) The line I-J extending completely across the diagram, which indicates that in the pure iron-carbon series the solid solution breaks down into pearlite at practically the same temperature.

Curves A, B, and C, Fig. 2, will be found to fit in with the equilibrium diagram, always remembering that the latter is built upon the *cooling* curves. It is perhaps wise to here place a caution with regard to the position of the lines shown on the diagram. The position of these lines will be found to be affected by the manner in which the cooling curves are made. In the first place, absolutely correct calibration of the pyrometer must be obtained, and in the second place it must be understood that (1) size of mass, (2) speed of heating and cooling, (3) degree of maximum temperature attained during the heating, all actually influence the temperature, at which the physico-chemical changes take place. In illustration of this point we cannot do better than instance the results contained in a paper given by Dr. Stead, F.R.S., at the Brussels meeting of the Iron and Steel Institute in 1913. Dr. Stead prepared a number of test-pieces containing practically nothing but iron and 0.90 per cent of carbon. This, as will be seen from the diagram, should have only one arrest on heating and one evolution of heat on cooling; therefore it was an extremely suitable steel for comparative determinations. One each of these bars was sent to contemporary metallurgists and institutions and results obtained for comparison. It may be stated that the figure given for the absorption of heat on heating covered the range from 719° to 746° C., whilst on cooling the change was variously stated from 697° to 719° C. It should be noted that the remarks made in the last paragraph apply even more to alloy steels, such as used in your work, than to ordinary carbon steels. After commending the equilibrium diagram to the careful attention and study of all interested in the heat treatment of steels, I now propose to leave it for the present.

Nickel-Chrome Steels—If other elements, such, for instance, as manganese, silicon, chromium, nickel, tungsten, vanadium, etc., are added to steel, the position and character of the arrests on heating and the evolutions on cooling such steels are apt to be modified. To take the steels D and E, Fig. 2—the nickel-chrome high-tension and air-hardening ones. The change to the solid solution state with absorption of heat takes place at approximately the same temperature on heating, but on cooling the breaking down takes place at a much lower temperature. Here is the explanation of the value of added nickel and chromium to a steel. It makes the carbon change more sluggish, *i.e.*, more easily controlled and suppressed, and here lies the explanation of the reason why such alloy steels may be hardened in larger masses and here also is one of the explanations as to why such excellent physical properties can be obtained by heat treatments. The added element usually brings about its influence by modifying the chemico-physical properties of the iron. It must be understood that the added element is usually in solid solution in the iron, sometimes also in the carbide. With the nickel and chromium content of air-hardening steels, the speed of cooling produced by air-cooling is quite quick enough to suppress the carbon change and present the "solid solution" state, whereas water-quenching is only effective more or less with carbon steels, according to the mass employed.

High-Chrome Steel (*Stainless*)—In Curve F, Fig. 2, will be found the heating and cooling curve of the high-chromium steel. Here the change to the solid solution state does not take place until about 800° C., and consequently if it is desired to harden such steel it must be heated to considerably higher temperatures than ordinary carbon steels. Again, upon cooling (and here it may be pointed out that this is an air-hardening steel), the change from the solid solution state takes place at varying temperatures, according to the maximum temperature to which it has been heated; the speed of cooling also affects the position of the recalescence point. If slow enough, the change takes place soon after 700° C. has been passed.

Twenty-five Per Cent Nickel Steel—See Curve G, Fig. 2. This steel is unique in that the critical points do not occur in those ranges of temperature met with in works practice, providing the composition under discussion is secured. The result is that no arrests or absorption are observed during heating and cooling, and we have, therefore, only to deal with the solid solution state, modified in properties by the presence of 25 per cent of nickel. It will be seen at once that it is this fact which explains the non-magnetic properties of this material.

High-Manganese Steel—See Curve H, Fig. 2. Here we have a steel which has no arrest upon cooling, *i.e.*, we obtain again the "solid solution," this time containing 12 to 14 per cent of manganese, which, if well preserved, *i.e.*, cooled with sufficient rapidity, is also non-magnetic. Recent researches by Sir R. A. Hadfield have, however, shown that such a steel after tempering (which in this case hardens the steel) does develop a definite arrest in the usual position of the carbon change-point; hence the dotted indication. If the steel be heated up without tempering, ordinary observations would not detect an absorption of heat at the critical point.

(*To be continued*)

Will Test Prospective Aviators

Dr. Isaac H. Jones, of 1831 Chestnut Street, whose researches have made him the most essential man in America to the raising of the tremendous army of aviators that the War Department is planning, has gone on a tour of the West to teach other physicians a thing in which he alone excels.

The feat which gained Dr. Jones such an honor, and a commission of major in the United States medical reserve corps, was the perfection of a method of determining the measure of balance in a human, and his possession of the stabilizing qualities needed for aviation work.

The most vital factor in the art of flying is balance, and without this the flyer is helpless in the air at great heights and incapable of making a proper landing. Most of the accidents have been due to a defect in this respect. Dr. Jones' method of determining the balance is through a minute examination of the ear, which has been found to be the seat of this faculty.

METHODS USED IN FINDING FUSELAGE STRESSES

By J. A. ROCHÉ, M. E.
Aeronautical Eng., U. S. A.

Reasoning leading to choice of criterion and methods used in finding stresses.

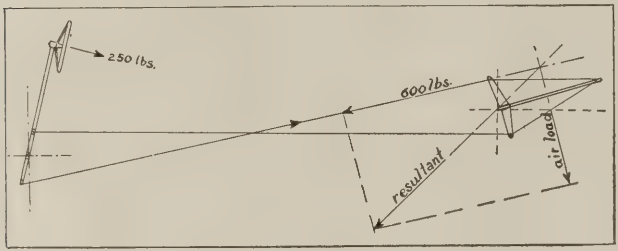
An aeroplane fuselage is a structure whose function is to connect the wings, landing gear and tail surfaces of the machine; hold them in their proper respective locations and transmit the stresses which hold the machine in equilibrium, in the air and on the ground from each one of these parts to the others. Its secondary function is, of course, to house the engine, aviator and accessories.

While in the air, the fuselage transmits from the tail planes to the wings moments which are necessary to give stability or to neutralize whatever couples may exist due to center of pressure and thrust line location.

In normal flight, the stresses due to these moments are slight, but in exceptional cases such as in recovering from a vertical dive, these moments and the stresses they cause are large.

It may seem at first that these can reach enormous values if the recovery be made very sharply by raising the elevators at a high angle, while traveling at a high rate of speed.

It has been measured that a man in the pilot's seat can exert a push or a pull force of about 250 pounds. With the leverage of a standard "Dep." control, the force that can be exerted on the control cables is about 600 pounds and this can bring about a reaction of 400 to 500 pounds on the elevators according to their shape, on which depends the position of the center of pressure behind the hinge.



The resultant of these two forces is as shown by the above figure, and this resultant can be used as a basis for a stress diagram of the rear end of the structure.

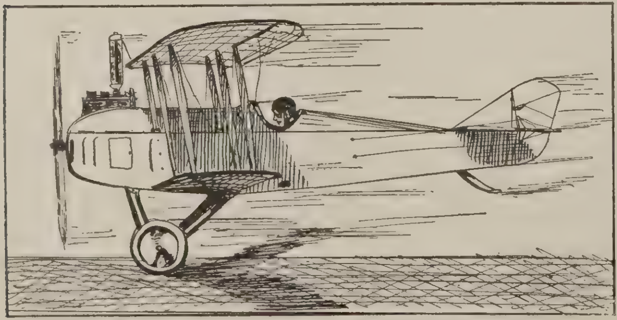
The stress diagram yielded is of the simple usual type. Usually no attention is paid to stresses in the rear end of the fuselage caused by landing shock and the front end is analyzed by itself in a rather crude manner.

The object of the following is to investigate the latter condition as thoroughly as possible taking into account,

Location of landing gear,
Location of center of gravity,
Inertia forces,
Point of application of all loads.

As a machine runs along the ground in normal position, the reaction force applied at the wheels, being equal and coincident with the resultant of the loads and inertia forces, must pass through the axis of the wheels and also through the center of gravity of the machine. This is not strictly true, because other forces may be at play helping the machine, namely: airloads on the main planes and other surfaces, however, it would be fair to assume that the roughness of the ground produced a force equal to the inertia forces. If the rolling friction is very high and the machine has a tendency to turn her nose, the tail air loads must act down to keep the machine in equilibrium, whereas if the rolling friction is too low the tail air loads must act up to keep the machine rolling on her wheels.

In the latter case, the machine will have a tendency to porpoise, in the former, it will have a tendency to nose over, but it seems that if the wheels are so located that the resultant of the weight reaction and rolling friction passes through the center of gravity, the aeroplane will then be stable as it strikes or rolls on the ground.



It is true that the rolling friction is a very variable factor, but it certainly has a mean value and we can assume that the inertia of rotation of the aeroplane will take care of most variations from this mean value of rolling friction.

It is not advisable to assume the machine landing with a perfect "pancake" and striking with wheels and skid together, for this is neither the worst nor the usual condition of landing. It is preferable to assume the machine landing on its wheels only in normal horizontal position and with tail planes neutral, which is a fair mean between the possible conditions mentioned above.

The stresses found can be those due to the normal loads taking no account of shock; and since shock would not alter the direction of the forces but only their magnitude, the stresses for any condition of shock can be obtained later by applying a proper constant to the normal stresses or by changing the scale of the stress diagram.

The work can be performed according to the following plan:

1—Draw to scale the fuselage under consideration and mark on it, the centers of gravity of the various loads which it must carry, label each one with its name and weight. Discompose each one of these loads and apply proper share to each one of the joints on which it acts.

2—Draw vertical and horizontal funicular polygons or two polygons at an angle to each other. The intersection of their resultants gives the position of the center of gravity of the system.

3—Draw reaction force passing through C. G. thus found and center of axle, make all load vectors parallel to it.

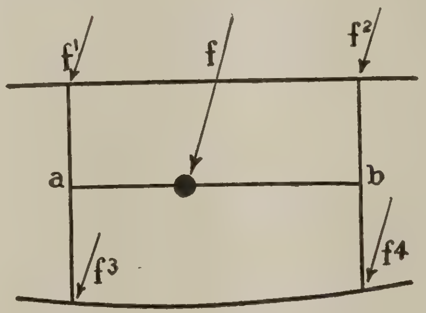
4—Draw stress diagram, closure will be considered as check on the work.

5—Design each member according to the stress it carries, taking bending or transverse forces into account. For the portion of a strut below the point of application of the load add to the direct stress shown by the stress diagram the portion of that load which had been considered as applied at the lower end. For the upper portion, deduct the portion of the load which had been considered as applied to the upper end.

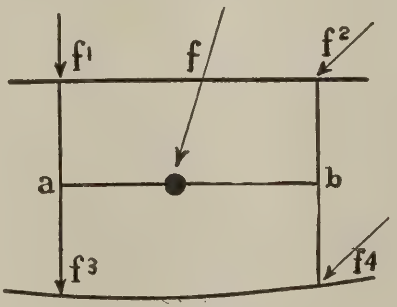
It was admitted in step 5 that the stress diagram was not the final operation in finding the close value of stresses in the members of the fuselage. This is due to the fact that this truss is loaded internally. Before starting to draw the diagram the forces have been discomposed in a definite way, we must now correct for the effect of this assumption which has made possible the construction of the stress diagram.

Step 5 indicates how the proper correction is made for the stresses in the vertical struts. The reason and method are obvious. A similar correction should also be applied in the horizontal members. It is clear that the various pin points sustaining a load will partake of the horizontal component of the force due to the inertia of that load. Not necessarily in the inverse ratio of their distances from that load, but in a way depending on the rigidity of the members through which this load is connected to them.

Thus, instead of having:



If strut *a* was elastic and strut *b* rigid we would have:



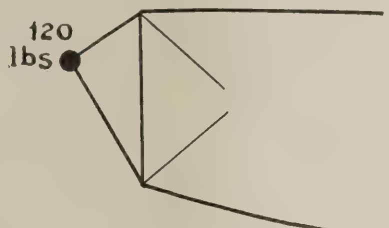
The resultants of these systems are equal in all respects; but the second, more correct assumption would cause a more complicated stress diagram, which would not show very different stresses in the longerons. It seems quite proper to make these corrections afterwards if they are desired at all, when the members have been designed and their degree of rigidity is known.

In the case of oblique members, both a vertical and horizontal correction must be applied. Thus, in spite of the efforts of this method to give close accuracy, there is still room for the engineer to make some corrections based on good judgment, but these corrections need not be made in most ordinary cases.

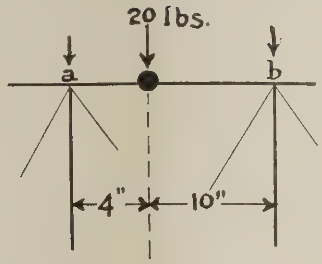
The present example illustrates the application of the method proposed here, a small variable angle of incidence biplane being assumed. The apportioning of loads to pin points is done as follows:

(1) *Engine and Propeller*—110 lbs.

This load will be considered as applied at the vertex of a small triangular truss which is in fact supplied by the engine crankcase. Thus:



(2) *Tanks, Fuel and Oil.*



Here joint *a* must take $\frac{20 \times 14}{14} = 14.3$ lbs.

b must take $\frac{20 \times 4}{14} = 5.7$ lbs.

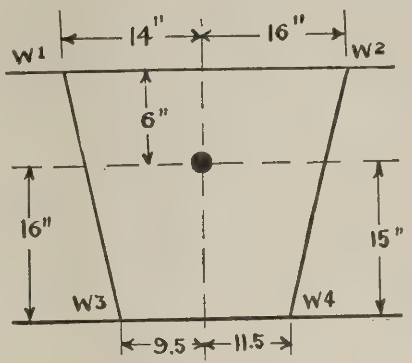
(3) *Wheels*—24 lbs.

These rest directly on the ground and impose no stresses in the structure.

(4) *Wings*—125 lbs.

As in the case of the power plant, these are taken as concentrated at the joints of their supporting truss.

(5) *Pilot*—160 lbs.



$$14\, W_1 + 9.5\, W_3 - 16\, W_2 - 11.5\, W_4 = 0$$
$$W_1 + W_2 + W_3 + W_4 = 160$$
$$6\, W_1 + 6\, W_2 - 16\, W_3 - 15\, W_4 = 0$$

These moment equations show that we have an indeterminate case as could be expected, since there is more than 3 points of support, all we can do is to eliminate one of the terms in a judicious manner.

By setting for example

$$W_1 = W_2 \times 16/14$$

We have then three equations containing 3 unknowns, as follows:

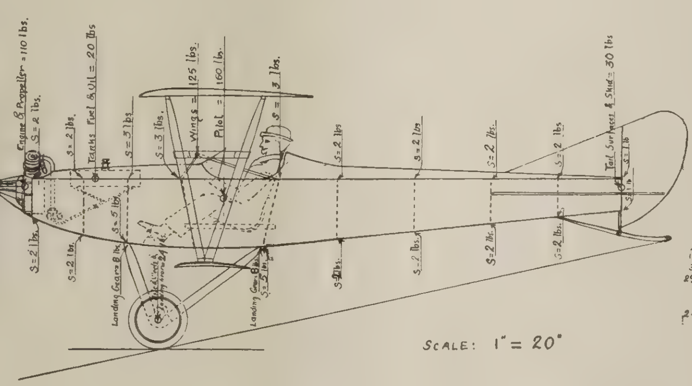
(1) $$\frac{14 \times 16\, W_1}{14} + 9.5\, W_3 - 16\, W_2 - 11.5 = 0$$

(2) $$\frac{6 \times 16\, W_2}{14} + 6\, W_2 - 16\, W_3 - 15\, W_4 = 0$$

(3) $$W_2\, 16/14 + W_2 + W_3 + W_4 = 160$$

$$OW_2\; 9.5\, W_3 - 11.5\, W_4 = 0$$
$$12.685\, W_2 - 16\, W_3 - 15\, W_4 = 0$$
$$2.142\, W_2 + W_3 + W_4 = 160$$

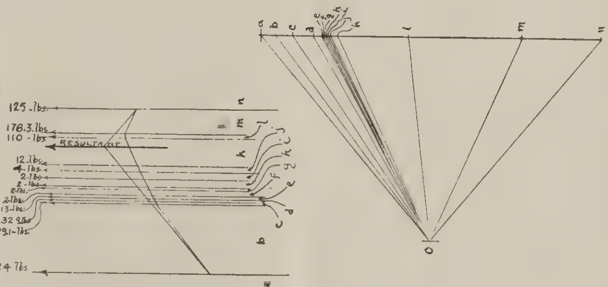
(Continued on page 653)



FUSELAGE LOADING DIAGRAM

Showing Location of Masses Considered in Stress Analysis.

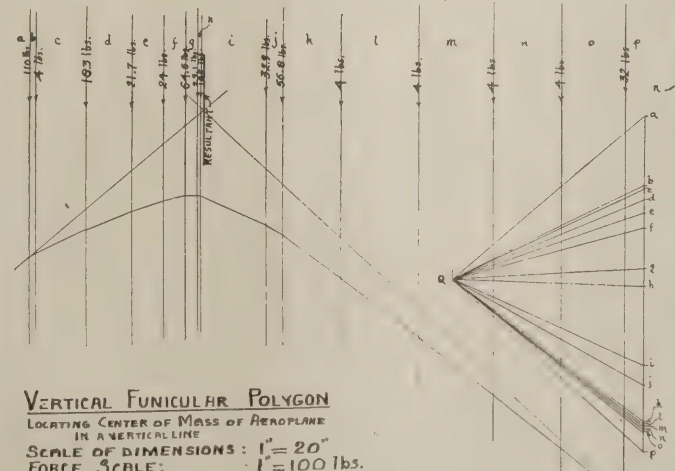
S = Own Weight of Structure.



HORIZONTAL · FUNICULAR POLYGON

LOCATING CENTER OF MASS OF AEROPLANE IN A HORIZONTAL LINE

SCALE OF DIMENSIONS: 1" = 20"
FORCE SCALE 1" = 100 lbs

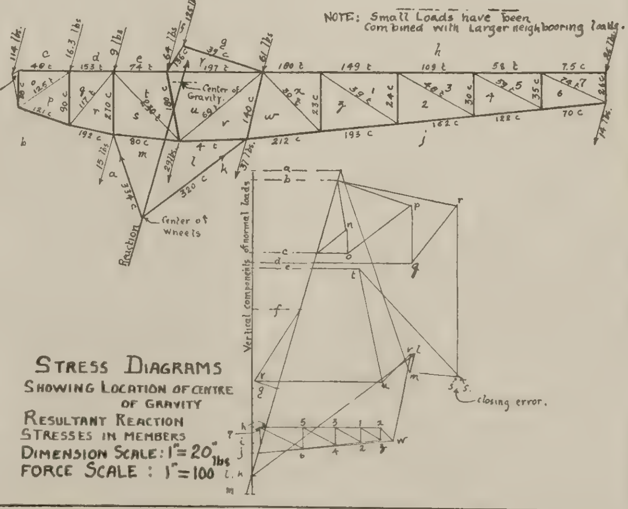


VERTICAL FUNICULAR POLYGON

LOCATING CENTER OF MASS OF AEROPLANE IN A VERTICAL LINE

SCALE OF DIMENSIONS: 1" = 20"
FORCE SCALE: 1" = 100 lbs.

J.A. Roché M.E. C.U. '15.



STRESS DIAGRAMS

SHOWING LOCATION OF CENTRE OF GRAVITY
RESULTANT REACTION
STRESSES IN MEMBERS
DIMENSION SCALE: 1" = 20"
FORCE SCALE: 1" = 100 lbs

FOREIGN NEWS

CANADA

Camp Borden, Ont., July 10.—A bolt of lightning, it is believed, struck the aeroplane, while in flight, of Lieut. Clare A. Page, of the Royal Flying Corps, who was hurled to his death here in a thunder storm last evening. The same storm drove down Cadet Donellin, who was seriously injured when his machine turned over upon landing, while a third member of the corps was able to land safely. Lieut. Page came from Hamilton, Ont.

FRANCE

Paris, July 9.—The Lafayette Squadron received yesterday from the hands of Daniel Vincent, Under Secretary of Aviation, a flag which Mrs. William G. McAdoo, wife of the Secretary of the United States Treasury, had presented to Jules Jusserand, the French Ambassador at Washington, on behalf of forty young American women.

Several French aviators, including members of Captain George Guynemer's squadron, were present at the ceremony. Lieut. William Thaw has been appointed flag custodian.

GERMANY

The Hague, July 10.—The *Cologne Zeitung*, commenting on the aviation program of the United States, says that it will be comparatively easy to find men for service on the other side of the ocean, where aviators will not come in contact with the German airmen and where laurels are easily earned without danger, but that as for the proposed hundred schools Americans have overlooked the fact that a tremendous amount of experience is required for instruction, and the ever-increasing experience in the war is far ahead of anything known in the United States.

"In America," it adds, "it is only thought necessary to endow schools with so much money and procure flying machines."

The newspaper remarks that the reports of America's wonderful new inventions do not surprise any one who knows the "land of unlimited possibilities." It would be more surprising, it adds, if Americans let this opportunity for the advertisement of their inventive power escape them. It concludes:

"We shall probably receive many more astounding figures until the time comes when American airmen appear on the west front. Our airmen are prepared, and await calmly the day when Americans come out, not under the fire of newspaper reports, but that of our machine guns."

GREAT BRITAIN

London, July 8.—Royal naval aeroplanes carried out a raid last night on the Ghistelles Airdrome, according to official announcement by the Admiralty to-day. Although heavily attacked by a German formation, bombs were successfully dropped on objectives and all the British machines returned safely.

An intensified demand for reprisals has followed the air raid of yesterday.

The Sunday *Times* says the crying need of 1917 is for aeroplanes. as it was for shells in 1915, and declares the Government must be compelled to realize that the airplane will be the ultimate and deciding factor of the war. It insists that thousands must be built with the help of America to carry the war into enemy territory.

The *Weekly Despatch* contends that the people are in the ugliest temper and no longer in a mood to endure official obstinacy.

Reynold's newspaper suggests it would have been well if members of the War Cabinet and the Government had gone among the people and heard their comments on the defenceless state of the capital. It adds:

"Every Londoner recognizes that yesterday's raid was one of deliberate murder and terrorism. The man in the streets wants a policy of reprisals on Rhenish towns put into effect immediately."

London, July 12.—Instead of counter-attacking on land in an effort to regain the small strip along the Yser near Nieuport, which they lost to the Germans on Tuesday, the British struck back yesterday and last night by making air raids on enemy supply depots in five different towns in Flanders, tonight's Admiralty report shows.

"Bombing raids were carried out last night by naval machines on Varssenaere, St. Denis-Westrem, Ghistelles and Ostend," says the statement. "Railway lines and an electric power station and railway siding at Zarren were attacked by gunfire from the air and bombs were dropped on a train near St. Denis-Westrem.

"A fire was caused by bombs dropped near the Ostend electric power station and a heavy explosion was caused at the Varssenaere railway dump, followed by an intense conflagration, which was still burning a half hour later. Several tons of bombs were dropped. All the machines returned home safely."

British headquarters in France also reports great activity in the air yesterday and tells of raids on German airdromes and ammunition dumps.

"In the course of the air fighting," the report adds, "four German aeroplanes were brought down and six others were driven down out of control. Three of our machines are missing."

British aviators were active also on the Macedonian front yesterday. They dropped bombs on the station at Angista, twenty miles east of Seres. At another point on the same front a German captain and a pilot were captured.

To-day's official statement reports the repulse of a German raiding party last night south of Lombatertzyde, in Belgium, and the night report tells of the driving off of a small force early this morning west of Queant (southeast of Arras), "leaving some prisoners in our hands."

JAPAN

(From a recent issue of the *Japan Times*)

At present altogether eight Japanese aviators are with the French military flying corps, according to a recent letter from Baron Shigeno, who is taking an active part in the aerial warfare against the Huns somewhere in France. They are Major Isobe, Baron Shigeno, Mr. Ishibashi, Mr. Kobayashi, Mr. Madzume and three others. Baron Shigeno reports tht Mr. Ishibashi and Mr. Madzume have obtained French military aviators' licenses, and the former has been appointed aviation sergeant by the French Government. Baron Shigeno writes that he has recently been provided with a military plane of the latest type and design called "spad" of which not many are found even in the French military aviation circles. He says that when he got the machine he was more delighted than if he had been decorated with the Legion of Honour. According to Baron Shigeno, the training of a military airman is very severe in France, and it is by no means an easy matter for even an accomplished aviator to obtain permission to proceed to the front.

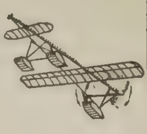
He must go through training for two months at first at a school where he practise how to give chase to enemy planes in a Newport machine. After he finishes the school he is sent to another school for the purpose of studying the use of aircraft-guns for one month, after which he is at last ordered to the front. He is not called a full-fledged military aviator in France before he has a good command of fancy flying.

While aviation among civilian airmen is generally considered as a thing of the future in Japan, and there is only a handful of local aviators now-a-days, it is of interest to learn that a popular aviation school has been recently established at Haneda, near Tokyo, by Mr. Tamai, a civilian aviator, and Mr. Aiba, former editor of the *Aviation World*, a popular Tokyo monthly devoted to aerial navigation.

The King and Queen at the Sopwith factory in England. T. O. M. Sopwith may be seen second from the left. The machines shown are triplanes, equipped with 130 h. p. Clerget Motors.

MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City
PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
LONG ISLAND MODEL AERO CLUB
401 Grant Ave., Cypress Hills, L. I.
BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md.
NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
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Illinois Model Aero Club News

By D. W. Pease.

At the meeting of July 6, the Illinois Model Aero Club held its semi-annual election of officers. The following officers were elected: president, D. W. Pease; first vice president, Thomas Hall; second vice president, Lynn Davies; secretary, Wm. Sprague; treasurer, W. H. Hitt; chairman of the contest committee, Wm. Schweitzer; chairman of the membership committee, Carl Hamlin; and chairman of the special activities committee, Arthur E. Nealy. With such a staff of officers, the success of the club in the coming summer is assured.

The new chairman of the contest committee has announced a hand-launched duration meet for twin pushers for Sunday, July 8, as Ashburn and it is expected that excellent results will be obtained in this meet.

Correction

In our issue of July 2nd we made an announcement concerning the activities of Mr. William P. Dean, Toledo, Ohio, whose telephone number was given as Collingwood 2787 and should be Collingwood 2878.

Aerial Acrobatics from an Aeromodellist's Point of View

(*Concluded from page* 607)

Such a man is Art Smith, incredible as it may seem. Having set his machines (not himself) a certain experiment he possesses such perfect confidence in his machine first and himself afterwards, that having so adjusted matters that a certain evolution must of necessity take place; he is capable of absolutely eliminating the human element while that evolution is being carried out, and also of reasserting it at the psychological moment to change that evolution, abnormal if you like in itself, into one which shall of itself bring his machine into a normal position once more. I have referred to Smith's perfect confidence; now, curious as it may at first sight seem, this confidence is also shared by the spectators of his performances. Whatever qualms or misgivings one may feel *beforehand,* while he is actually carrying them out, they all disappear as if by magic. So much is this the case that side by side with the intense scientific interest with which one watches these experiments, one can simultaneously see the humorous side as well, and one finds oneself actually smiling or even quietly laughing and reflecting: "Well, really, you know, but this *is* droll." "Stunts" don't affect you in this way—quite the reverse.

Broadly speaking, an expert aeromoddellist can make his machine accomplish all that Smith allows his full-sized machine to do; for instance, he can make it loop the loop, fly upside down, etc. It is, of course, obvious that such results are not always brought about by the same means as Smith adopts, and readjustments and resettings are necessary to bring them about; but none of these affect the main issue which is this.

The experiments of aeromodellists have shown that correctly designed model aeroplanes are naturally stable in a very remarkable degree, and that if temporarily upset in any or every conceivable way they will invariably recover themselves, provided always that the circle of their natural radius of recovery has no obstacle, such as the earth, etc., as tangent. Smith's performances show that the same thing is true of full-sized machines generally speaking. Many aeromodellists felt quite certain in their own minds that this was so; none, I feel sure, could have expected so early a practical proof of the same.

The debt which aeromodellists owe to Smith and others who are now performing in a like manner can, in the writer's opinion, scarcely be over-estimated. Surely nothing could have happened calculated to give them greater encouragement. Regarding the matter for a moment from the other side, is it too much to hope that experiments with models will now be regarded as worthy of more attention and recognition from designers and builders of full-sized machines? Experiments, I mean, which shall have for their aim the investigations of the various laws of similitude, etc., which do undoubtedly apply between model and full-sized work.

Let us sincerely hope that the new spirit of sport, which is now bound to come, will bring about, the sooner the better, a model international meeting, of an aviation character, in which American aeromodellists may have a similar opportunity of demonstrating their skill whether the meeting be held in this country or abroad.

A model yachting triumph, greater in a sense than the above, is that a most successful yacht was built which was designed purely as a result of certain experiments made with models. When we can record similar and even greater model aviation triumphs than that just referred to in the case of yachts, we shall feel that model aviation has not been stimulated and encouraged in vain.

The sensation experienced by the writer whilst watching Smith when he performed over the Hudson River was, not that he was looking at a machine and a pilot at all, but that he was gazing at a large model fitted with an intelligence which was mechanically perfect, and that so long as nothing collapsed or broke under some sudden or undue strain failure was impossible.

Physically strapped to his machine as he is, Smith and his machine are one; mentally he also appears to be part and parcel of it, and in this sense one sees here that apparently impossible thing, a mechanical device, which is different from all other mechanical devices in that it is imbued with an intelligence all its own. What new and valuable information may we not hope to learn from such? The amazing part being not what Smith does so much as what he must refrain from doing, or trying to do, whilst executing his various aerial evolutions.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Constructing a Radiator for the Gnome Engine

One thing we have never understood is the fact that they have never furnished radiators with rotary engines, and last week we decided to put our mind to the question and see wherein the difficulty lay. Far be it from us to accuse our engineers of lying down on the job, but it seems to us that the trouble has been that they didn't want to face the immense difficulty of having a revolving radiator. After deep study, we believe that we have hit upon the solution of the problem. Our radiator will be found to be very cheap, depending entirely on the ingenuity of the constructor. Here follows the description. (Fair warning!)

It is a well known fact that the larger the radiator surface, the larger will be the cooling surface. *Ergo*, if we have a radiator that completely surrounds our motor, we will have the most efficient cooling apparatus ever devised by the brain of man, woman, child or lunatic. However, there is one danger that we must guard against: that is we must not keep the motor so cool that the gasoline will freeze. So with these thoughts in our mind, we devised the following scheme:

At night—this is very important—approach any house whose owner is known to sleep soundly. Steal up to the front windows and secure seven screens from the windows. (If in winter and the screens are not up, descend to the cellar and take them from there.) Cut the wire screens from the wooden frames, and carefully number each screen to correspond to the firing order of the cylinders. (*Very* important.) Note. It has been the experience of the writer, around engines on aviation fields, that number six cylinder misses the most. We don't know why this is, but very many times we have heard a pilot come down and tell his machanician that "number six is missing." We have often wondered why they didn't institute a search for it at once, but that is another story. And as number six cylinder is missing so often it seems a waste of time to construct a radiator for that cylinder. Therefore give that cylinder some other number). After having carefully numbered each radiator unit, form each one into a cylindrical shape, and pass gently over the top of each cylinder, nailing into place rigidly through cylinder walls. The radiator is now complete, ready for operation. It has the advantage over other radiators in that it not only cools the engine efficiently, but being constructed of mosquito screen, keeps insects off the cylinders.

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Lost in Transit

A while ago at the Mineola Aviation Field on Long Island, one of the pilots was unfortunate enough to make a precipitous drop from fifty feet, completely smashing the machine, yet miraculously escaping from what seemed certain death. As he was dusting himself off, and explaining the cause of the accident to some onlookers, a small boy came racing across the field, and held out his hand.

"Here," he said, "yer dropped this nickel the third time yer rolled over!"

A Dry Joke

Wheeling, W. Va.—West Virginia authorities are investigating the story that aeroplanes are being used to smuggle whiskey from wet portions of Kentucky into West Virginia. With all railroads, rivers and highways guarded, the air route is the only one open to the whiskey traffic.

At last the day of utilitarian purpose of the aeroplane!

No Brains

The lightning bug is brilliant,
But he hasn't any mind.
He blunders through existence
With his headlights on behind.

WHY, THERE'S NOTHING TO BE SCARED OF IN THE AIR— —HERE WE ARE GOING ALONG—
—DON'T HAVE TO BE WORRYING ABOUT HOLES IN THE ROAD—— TRAFFIC COPS —DANGEROUS TURNS— RAILROAD CROSSINGS ——NOTHING A TALL——
—WHY, I'LL BET TWENTY-FIVE PER CENT OF THE PEOPLE DOWN BELOW ARE IN FEAR FOR THEIR LIVES EVERY MINUTE!
YEAH— WELL, I KNOW THAT AT LEAST FIFTY PER CENT OF THE PEOPLE UP HERE FEEL THE SAME WAY!
C. A. Voight

Courtesy N. Y. Mail

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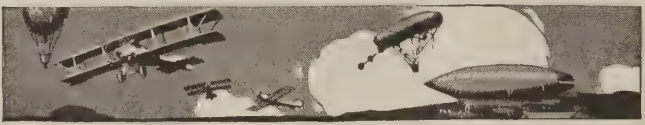

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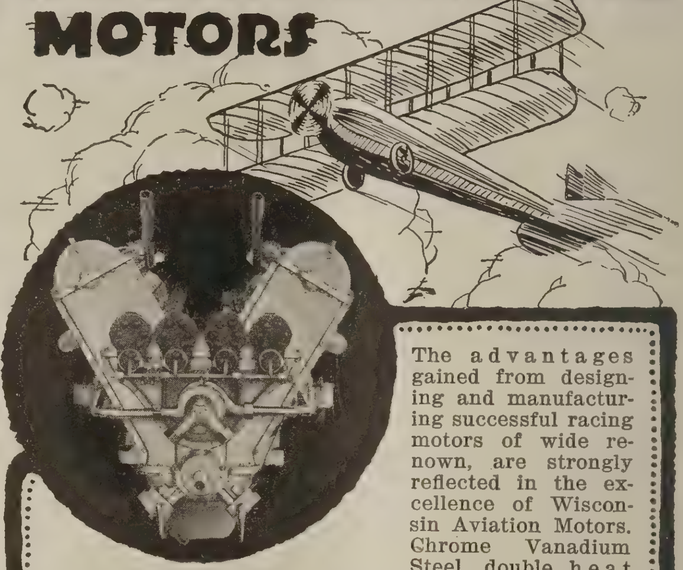

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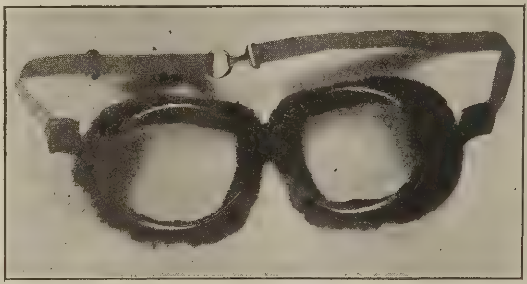

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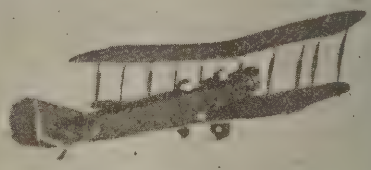

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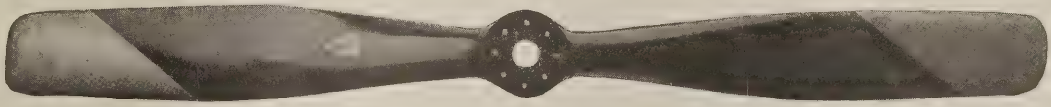

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Fuselage Stress Analysis

(*Continued from page 643*)

$$W_2 = \frac{\begin{vmatrix} 0 & +9.5 & -11.5 \\ 0 & -16 & -15 \\ 16 & 1 & 1 \end{vmatrix}}{\begin{vmatrix} 0 & 9.5 & -11.5 \\ 12.685 & -16 & -15 \\ 2.142 & 1 & 1 \end{vmatrix}} = \frac{-22800 - 29400}{-146 - 305 - 123} = \frac{-52200}{-96.9} = 53.8 \text{ lbs.}$$

$$W_1 = \frac{16 \times 53.8}{14} = 61.5 \text{ lbs.}$$

$$W_3 = \frac{\begin{vmatrix} 0 & 0 & -11.5 \\ 12.68 & 0 & -15 \\ 2.142 & 160 & 1 \end{vmatrix}}{-96.9} = \frac{-32.15 - 23300}{-96.9} = 24.11 \text{ lbs.}$$

$$W_4 = \frac{\begin{vmatrix} 0 & 9.5 & 0 \\ 12.68 & -16 & 0 \\ 2.142 & 1 & 160 \end{vmatrix}}{-96.9} = \frac{-19250}{-96.9} = 19.9 \text{ lbs.}$$

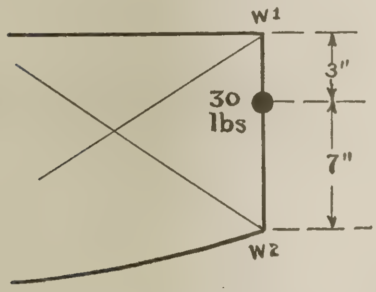
Check

$$\begin{array}{rl} 19.9 = & W_4 \\ 24.1 = & W_3 \\ 61.5 = & W_1 \\ 53.8 = & W_2 \\ \hline \text{Total } 159.3 & \end{array}$$

(6) *Tail Works*—30 lbs.

$$W_1 = \frac{30 \times 7}{10} = 21 \text{ lbs.}$$

$$W_2 = \frac{30 \times 3}{10} = 9 \text{ lbs.}$$



At this point it is interesting to study the retarding effect of the rolling friction which has been assumed. This force as scaled from the diagram is

$$F = 147 \text{ lbs.}$$

since

$$F = Ma$$

and

$$M = \frac{W}{g} = \frac{508}{32.2} = 15.8 \quad \text{pounds of mass}$$

$$\text{Retardation } a = \frac{F}{M} = \frac{15.8}{-147} = -9.3$$

$$\text{also } a = \frac{dv}{dt} = \frac{dv}{ds}\,\frac{ds}{dt} = v\,\frac{dv}{ds} = -9.3$$

$$\text{and } \int v\,dv = \int -9.3\,ds$$

$$\text{Integrating we get } \frac{v^2}{2} + c = -9.3\,s + c$$

$$\frac{v^2}{2} = -9.3\,s + c$$

Proceeding to determine the value of c we know that in the case of a landing made at 40 m.p.h. at the instant of first contact with the ground:

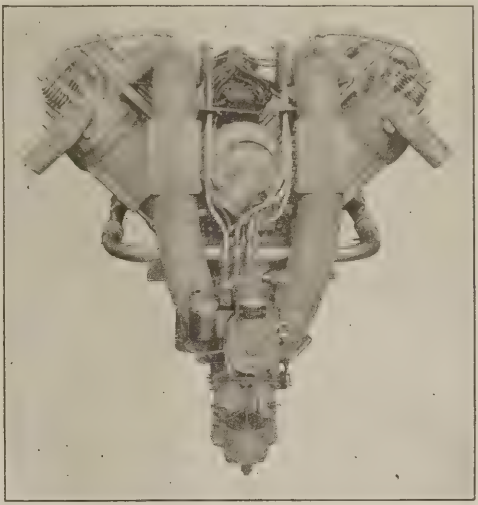
$$V = 58.6 \text{ ft./sec.}$$
$$\text{and } S = 0$$

$$\text{then } \frac{58.6^2}{2} = c = 1720$$

and when the aeroplane has finally come to rest $V = 0$ and

$$S = \frac{1720}{9.3} = 185 \text{ ft.}$$

and this figure is not an improbable one for the machine in question, and shows a capacity on the part of the landing gear to take care of rather rough ground without causing the machine to turn on its nose. If this figure was checked on the field, it would prove that the rolling friction had been correctly assumed.



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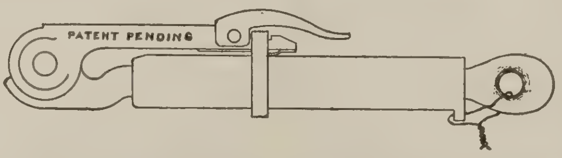

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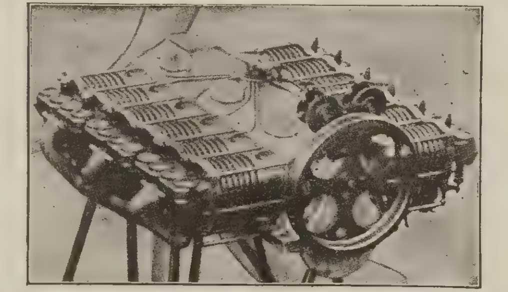

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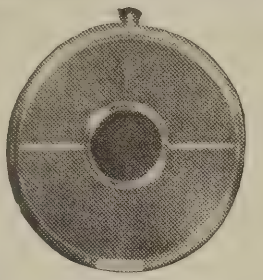

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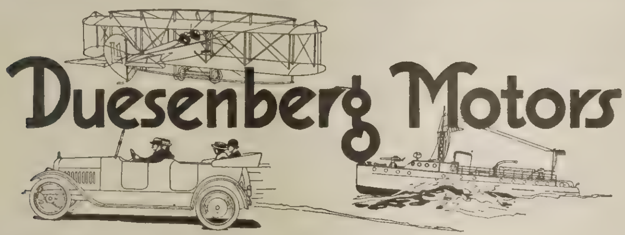

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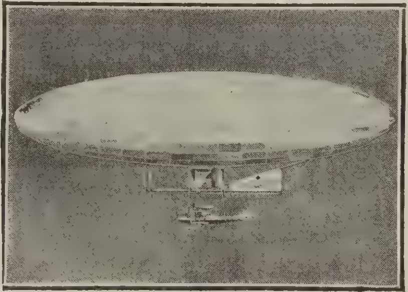

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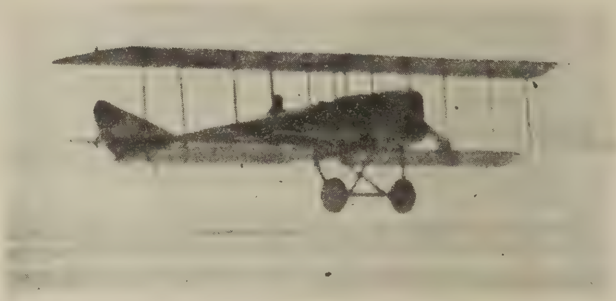

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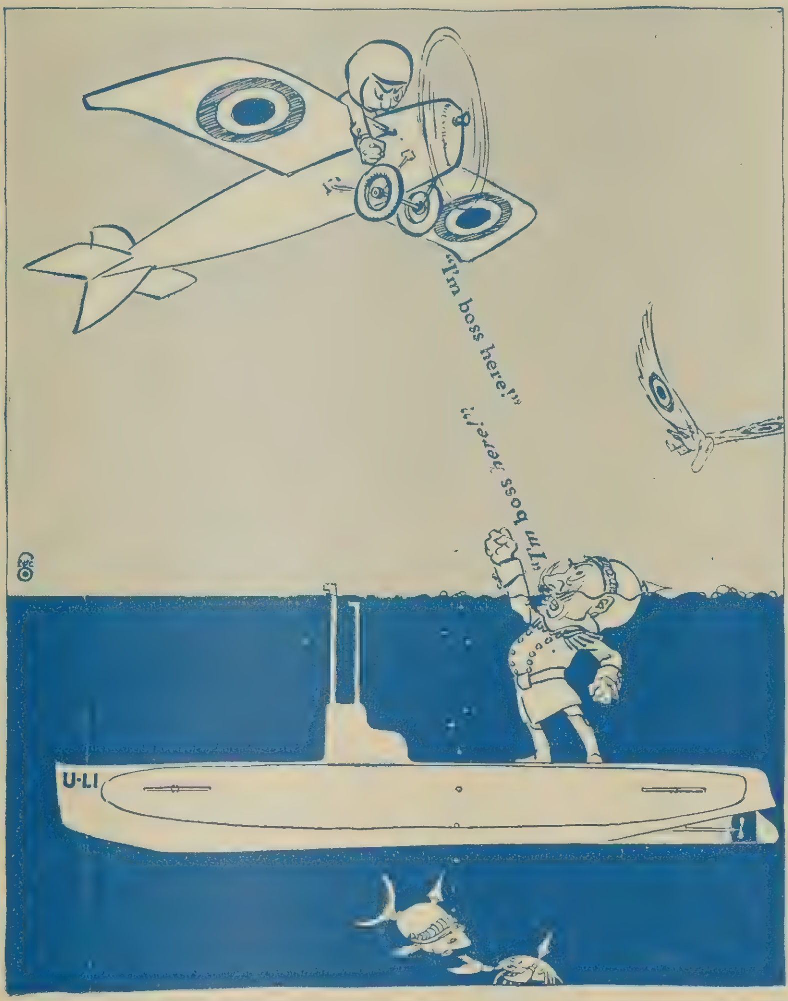
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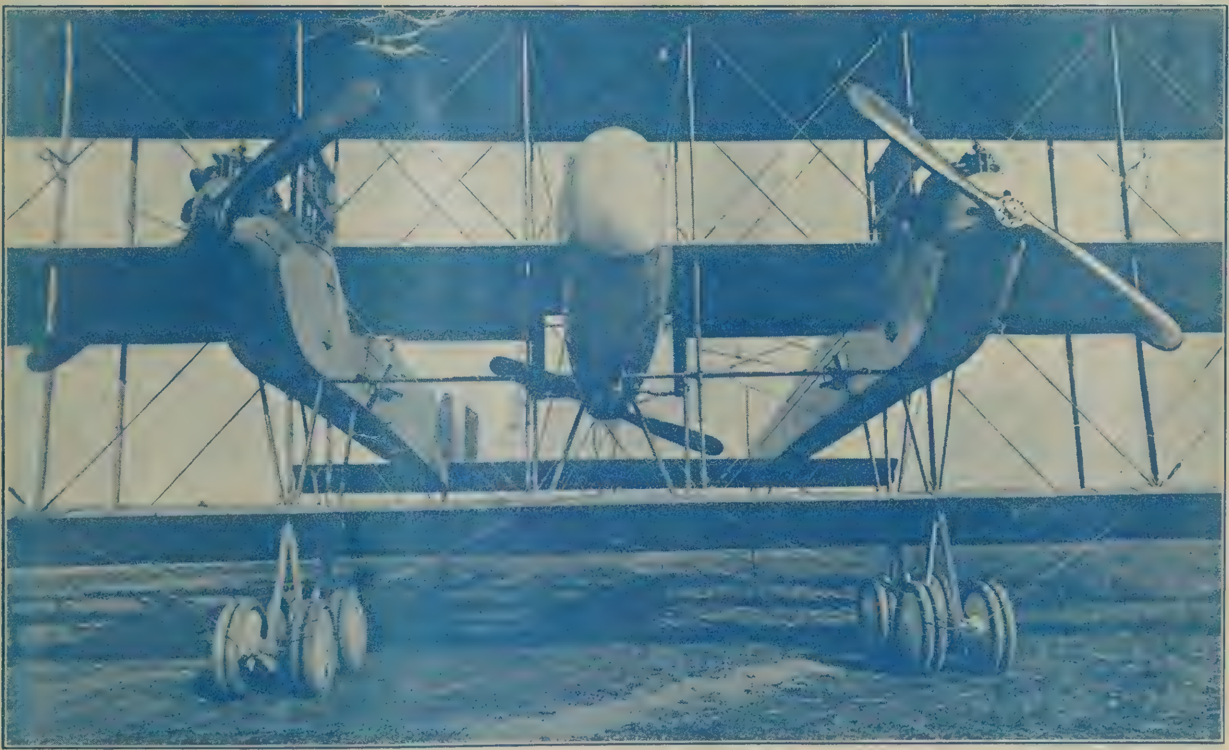

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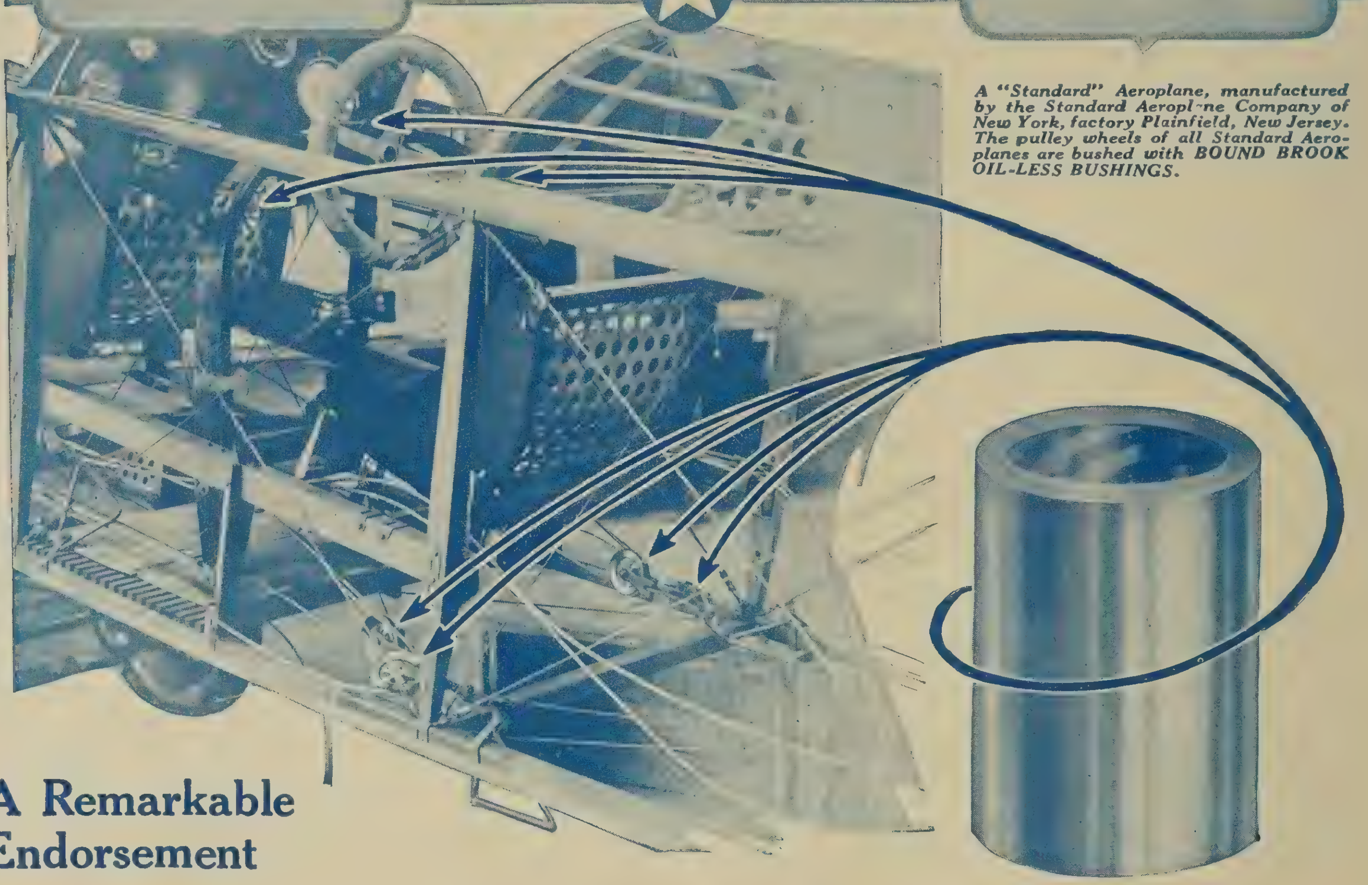

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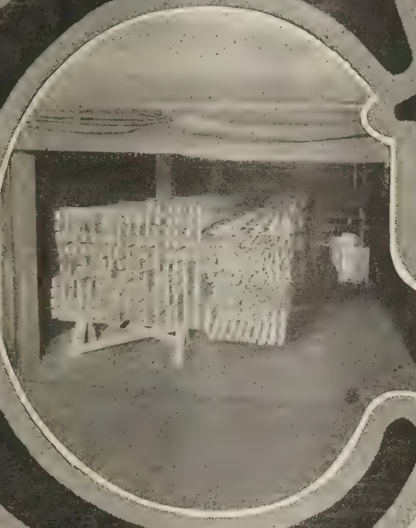

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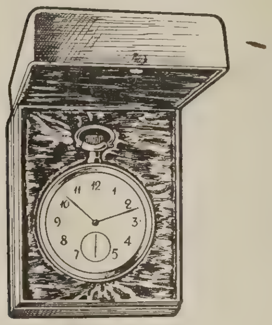

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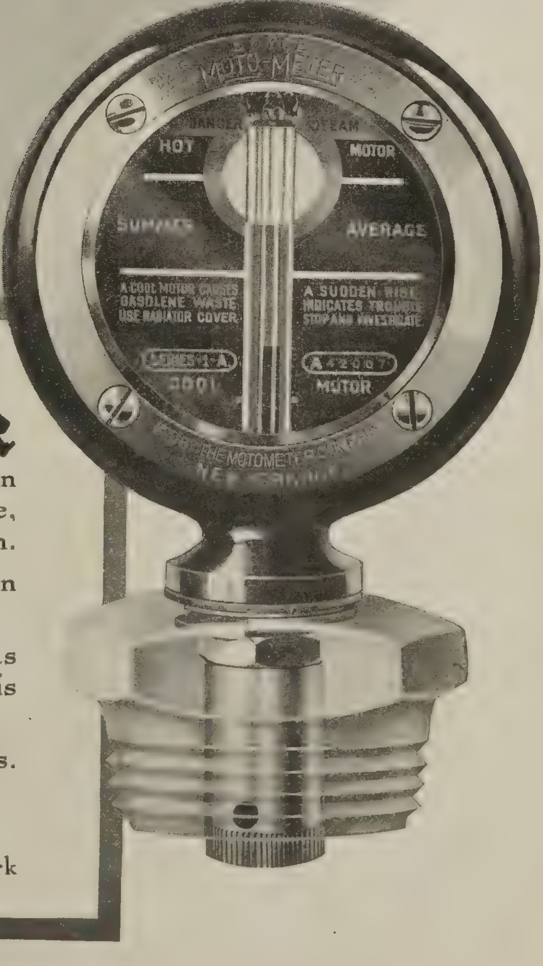
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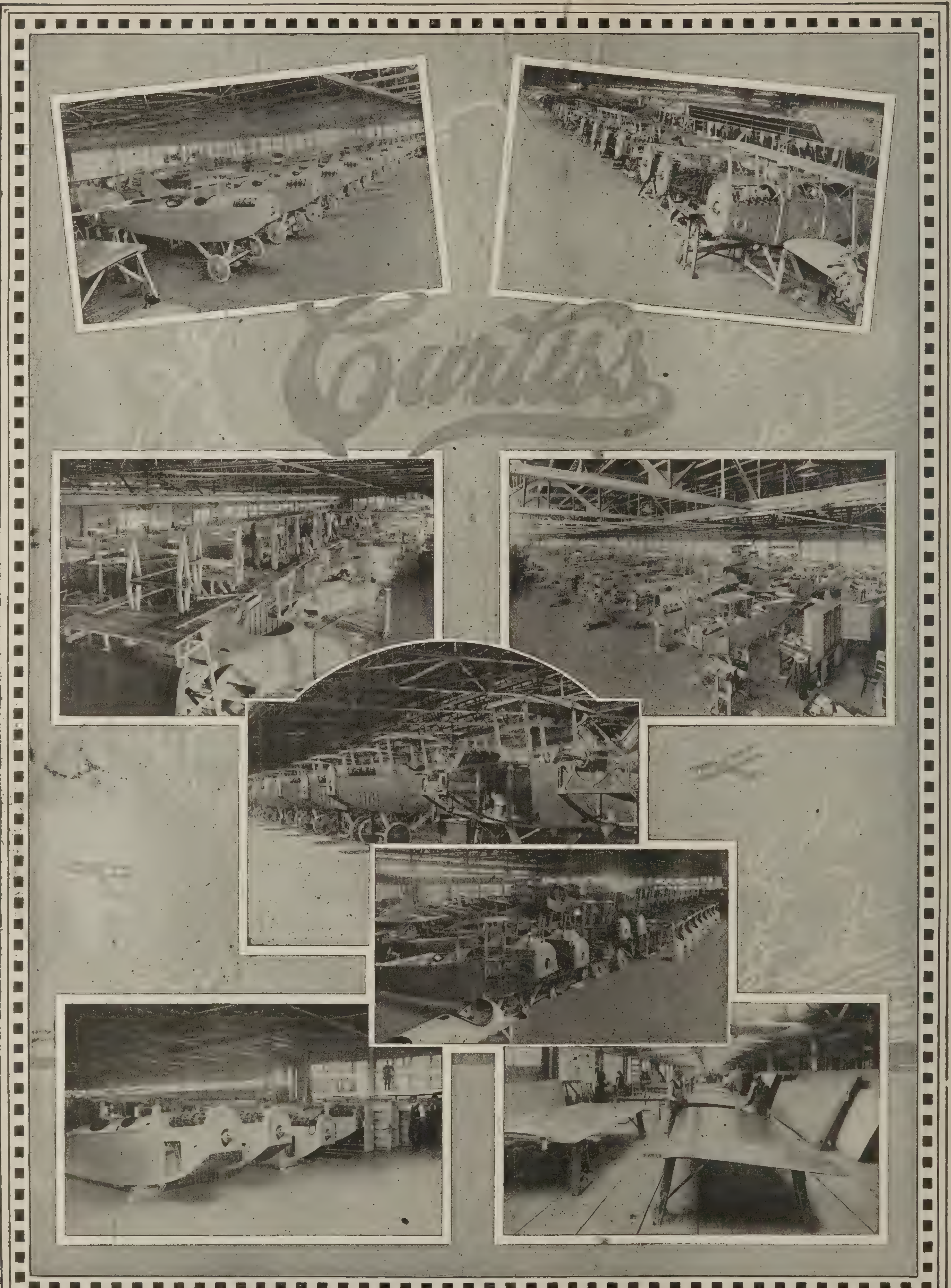

Such photographs as these tell better than words the story of Curtiss progress and manufacturing capabilities

THE CURTISS AEROPLANE CO., Buffalo, N. Y.

Member Aircraft Manufacturers Association

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AERIAL AGE
WEEKLY
THE TRADE AUTHORITY

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$640,000,000 ARMY AERONAUTIC APPROPRIATION APPROVED

THE $640,000,000 army aeronautic appropriation, which went through the House of Representatives on July 14, went through the Senate on July 21st.

One week was lost, due to the insidious efforts of trouble makers who attempted to discredit the members of the Aircraft Production Board.

As every day lost means the loss of about 5,000 lives and about $500,000,000 to the Allies, these obstructionists and trouble makers are giving comfort to the enemy to say the least.

While regretting the delay of a few days we must be thankful that it is over—and the country can now go ahead with the aerial program.

Alan R. Hawley, the president of the Aero Club of America, calls attention to the next two steps to be taken.

"First of all," says Mr. Hawley, "prompt steps must be taken to set the machinery going to turn out the thousands of aeroplanes needed in the shortest time possible. The Aircraft Production Board already has done some very meritorious work in co-ordinating the manufacturing facilities and listing the sources of supplies of raw materials.

"A number of the military aviation training camps are already in operation and others will be in operation soon. It is now a case of getting all together and pushing the wheel all together to turn out the 10,000 aviators and the aeroplanes needed to train and equip them.

"Simultaneously steps must be taken to evolve a similar program for the Navy Department, so that 10,000 naval aviators can be trained for the naval aerial operations against the German fleet and U-boat bases, which should take place at the same time that aerial operations are conducted on the western front against German military centers, military bases and German railroads. Leading Senators and members of the House of Representatives have assured the Aero Club of America that there will be no trouble whatever to get the appropriations necessary for carrying out a substantial naval aeronautic program as originally outlined in the *Herald,* and that Congress will allow the appropriations as soon as Secretary Daniels asks for them."

Representative Murray Hulbert, of this city, who, together with Senator Morris Sheppard, of Texas, is directly responsible for the bill appropriating $640,000,000, said: "I wish particularly to thank AERIAL AGE for its consistent and energetic support to the measures providing for aerial expansion and of the Sheppard-Hulbert bill."

At Last, the Aeroplanes

(*Editorial in N. Y. Times*)

The passage by the Senate of the Aviation bill, over which a prolonged debate was threatened, is encouraging to the country. The bill, once it was permitted to take shape, was quickly accepted. The obstructionists were on hand, but they were powerless. But the bill was a long time in taking shape. We should have been hard at work building up a military air service two years ago.

Now the pleading of Admiral Peary and Admiral Fiske, of all the aeronautic organizations, of every experienced American soldier who has made himself familiar with modern warfare has been heeded. An ample fund has been provided for the beginning of such an air fleet as the world has never known. Much of the machinery for the operation of the new law is ready. Much more can be done, with comparatively little delay. Presently we shall be training an army of airmen and building machines of approved types. It is no longer doubtful that the United States will do its share to end the war through its air service. We have begun. What we begin we carry through.

Coincident with the final passage of this measure there is news of another murderous German air raid on English coast towns. It should spur us on to quicker action. There is no time for red-tape delays. Our men and their machines should be sent to France in contingents every month.

Build the Air Fleet!

(*Editorial in N. Y. Sun*)

The Senate obeyed the demand of enlightened public opinion on Saturday by passing without delay the bill providing for the creation of an air fleet adequate to crush the German flying service and blind the armies of the Kaiser.

It is now the task of the executive department to act with the same speed in the manufacture of aircraft and the training of pilots, observers and gunners. The pocketbook of the nation has been opened; all the money that is needed is available, an unlimited number of men are ready for service, the industries of the country are at the disposal of the Government and the knowledge acquired by our allies in three years of war is at hand to guide us.

The Congress has done admirably in this vital project; the Executive must not fail us.

Toward Air Supremacy

(*Editorial in N. Y. Tribune*)

It is understood that the great appropriation now secured for the aviation service will serve to establish and equip a fleet of about 22,000 aeroplanes, with a personnel of 100,000. It is a tremendous undertaking, and for some time to come it would be unreasonable to expect any obvious results in the field. According to advices from Washington, the first few months will be given over mainly to the construction of machines for the training of airmen, and it has already been announced that contingents of instructors have been sent hither from France, or will be before long.

The number of machines to be turned out in the first year will, it is said, be at least 3,500. It is none too many, but it is a good beginning, and a great increase is expected in the year following. If we are to credit reports from France, the Germans expect to have 3,500 on the fighting line by next spring. If this figure is supposed to represent a permanent force, it is sufficiently formidable, for it is to be noted that to keep it up a fresh supply of from 30 to 50 per cent a month must be counted upon.

Mr. Howard E. Coffin said some time ago that it was in the air that we had the greatest chance to outmanoeuvre Germany, and it is admitted on all hands today that supremacy of the air is one of the essential conditions of victory. Such supremacy should now be assured and rendered permanent by our effort.

Army Aviation Bill

(*Editorial in N. Y. Herald*)

After rejecting every amendment proposed during a debate that lasted less than an hour the Senate passed on Saturday an aviation bill that carries an appropriation of six hundred and forty million dollars. So prompt was this patriotic procedure that the Speaker of the House should be able when he receives the bill today to transmit it at once for the approval of the President. The action of Congress in this measure has been so commendable that the country's war potentialities are at a stroke enormously advanced in the one direction where they have been most deficient. Undoubtedly equal celerity will characterize the forty million aero grant asked for the navy.

Now that the first step has been taken on the financial side, the same energy and skill will, let it be hoped, be exercised to begin the needed organization and to assemble the equipment and secure the material. Of prime importance is the provision of all the accessories that spell efficiency, notably, everything that will contribute to the creation and training of a great air corps. Aero stations must be established in different sections of the country, the hearty co-operation of certain plants be gained and the greatest care taken that no group of men nor any special localities be permitted to control the output. Let Detroit contribute, but not command.

As a beginning many thousands of training planes must be turned out in order to sustain the enthusiasm and urge forward the eager volunteers whose ambition to be assigned to the air service and whose desire to be enrolled without delay are proof of the hold this third branch of defence has upon the imagination of the youth of the nation. Craftsmanship in this new energy of war is gained only by intense training and by the possession of many excellent mental and physical qualities, fortified to a high degree by a temperament that comes both by the light of nature and through the gift of fortune.

Let Us Turn Borrowers

(*Editorial in New York Tribune*)

Shortly after the Wright brothers had taught the world to fly certain patriotic and foolishly trustful gentlemen began to shout into the deaf ear of Congress the importance of developing the invention. Congress did not even know that the unsophisticated gentlemen were speaking. Within a few months America was almost forgotten in aviation. The thunder of the discovery echoed louder in France, Italy, Germany, Austria and England than did the original, even in Dayton, Ohio. While European countries were building better planes, breaking more flying records, in fact, developing the science of aeronautics, we were interested in this marvellous creation of American brains only to the extent of enlivening a Roman holiday with circus stunts in the air.

When the European war broke out the unsophisticated gentlemen raised their voices again, appealing to Congress and the Administration. This time it was impossible to ignore entirely the demand for aerial preparedness. We started an aeronautic department on a puny scale. However, the army soon became conscious of wings and their value. General Pershing, after his Mexican excursion, declared that one aviator was worth a division of cavalry. Lord Kitchener's estimate was that one flying man was worth an army corps. Washington did not really begin to think anything at all about the matter until we had been at war for several months.

Early last week the War Department issued a call for more aviators. That this belated appeal was at all necessary was due to nothing but stupidity. A little clique of military-political strategists, nurtured by the War Department, wanted to make the air service a gentlemen's club. Thousands of young men who have now volunteered for other branches of the service were rejected because they did not possess the right college diploma and the necessary political props to make them eligible for commissions in the aviation corps. The educational qualifications were made ridiculously severe, and there was so much red tape attached to securing appointment for the aviation schools that thousands of applicants, after waiting for months, gave up the effort and entered officers' training camps.

In one of his brilliant economic studies Professor Thorstein Veblin has written a fascinating chapter on the art of borrowing, showing how nations which have not originated but borrowed the cultural and industrial conceptions of other peoples have succeeded in utilizing and developing what they borrowed beyond the use made of it by the originator. He cites in proof innumerable historical instances, to which America of late years could add hundreds of striking examples. Aeronautics is only one. But now that we are pressed by necessity, let us disregard the fact that we built the first heavier-than-air flying machine. Let us remember that we have fewer aeroplanes and fewer aviators than any other great nation.

For once let us turn borrowers. Let us borrow unblushingly anything and everything in the aircraft of other nations that is better than our own. Let us borrow freely from our allies in organizing our aerial service, and the powers in Washington will soon find that it does not require a college graduate to pilot an aeroplane and shoot a rapid-firer. Finally, let us borrow and act on the idea, which is pretty well established, that we cannot win the war unless we have an overwhelming preponderance in the air. And let us start borrowing right away.

In War, Attack!

(Editorial in N. Y. *World*)

Winston Spencer Churchill speaks for perhaps a majority of British blue-water experts in urging a naval offensive. With the United States, the Entente has such a preponderance of big ships that it might well risk some of the older ones in such an attempt on the German Navy as must appeal to seamen. Perhaps the time has come to "dig the Germans out like rats," as Mr. Churchill once said in a much-criticised statement.

Rear Admiral Fiske, U. S. N., shows that reprisals on German cities for air-raid murders in England will have little value, and must overcome the disadvantage in distance. Such activities are not in any event, for American aviators. But hydroplane attack on the bases of the German fleet may be undertaken with advantage as to distance, since the Entente commands the sea and can establish floating bases. Nothing could so quickly end the submarine menace as repeated smashing up of the fleet in its harbors. For that, aeroplanes, and aeroplanes, and more aeroplanes are necessary; and we are building them.

The one sure rule in war is to attack when possible. The Entente is attacking on land, at last with substantial results. Its immense fleets are fairly tugging at their anchorages to get at the enemy. Unless, as Mr. Churchill hints, the naval powers wish the submarine to demonstrate the futility of fleets, they should attack the German Navy on the surface, and underwater, and in the air above, in overwhelming strength.

Aviation

The great bronze birds are calling,
They are calling out of the blue.
The great bronze birds are calling,
Calling to me and to you.

They are calling us to conquest
Of the delicate, airy deep,
Where the stars like seeds are scattered,
And the unknown forces sleep.

The great bronze birds are beating
A sure way into the blue.
Yes, Heaven and Earth are meeting
And calling to me and to you.

They are calling us to shatter
The bonds that are just of sod,
For the great bronze birds are wafting
The Earth to the throne of God.

BEATRICE IRWIN.
Author of "The Pagan Trinity," "The New Science of Color".

The Eyes of War

CLINTON SCOLLARD OF THE VIGILANTES

A Hundred Thousand Aeroplanes are needed from America for the Western Front.—Newspaper Headline.

They call them "the Eyes of War,"
These swiftly soaring things
That sweep o'er the sanguine fields of Thor
With the whirr of their driven wings.

Hither and yon they dart,
And fearless their pilots are
That seek the foe and rive his heart
At the door of the ultimate star.

Since ours is the fate to fight
On the land, on the seas, in the skies,
Give us that we may see to smite
A hundred thousand eyes!

THE NEWS OF THE WEEK

Navy's Need for $45,000,000 for Aviation Explained to Speaker Clark by Mr. Daniels

Secretary of the Navy Daniels has written the following letter to the Speaker of the House of Representatives:

"My Dear Mr. Speaker: There is being transmitted to the Congress an estimate for a deficiency appropriation of $45,000,000 under 'Aviation, Navy.' In explanation of this estimate I desire to bring to your attention the rapidity of the development almost day by day of material and operation of all classes of aircraft. These facts have, of course, been prominently brought to your attention by the appropriation for the construction and operation of aircraft for the Army.

Although naval operations in this field are far less in volume than those of the Army, they are of primary importance in the successful prosecution of the war, and the Army and Navy are working in perfect harmony and co-operation as to aeronautics. The information which we receive constantly from abroad, and the maturing of our own war plans, which must of necessity be based on the latest available information and must be shaped in conjunction with those of our allies make it apparent that the existing appropriations for naval aviation, based on the department's earlier estimates, are now inadequate.

The $45,000,000 for which I am now asking is needed for the development of our own coast patrol from naval bases for the development of our air scouting service in conjunction with ship operations and for carrying out our plans of co-operative operations afloat with our allies.

The number of machines which will be needed for naval operations in addition to the large number provided for by the Army bill will, of course, necessitate a tremendous expansion in the present available building facilities in this country. In addition to purchasing from existing and prospective private plants, it is my intention to assist in this expansion by providing facilities for building a part at least of the planes we shall need. These facilities will also be available for the most rapid experimental work in order to enable us to keep up with development without interfering with the large-scale production which is essential.

Funds are also necessary for the expansion and development of our existing air bases and for the establishment of a limited number of additional ones.

I trust that the above will give you the salient facts which necessitate this deficiency appropriation, and I shall, of course, be prepared to give any detailed information desired at any hearings which the committees of Congress may decide to hold on this matter.

Sincerely yours,
JOSEPHUS DANIELS,
Secretary of the Navy."

Massachusetts Institute of Technology Will Open Areonautic School

Boston—The Massachusetts Institute of Technology will open a ground aeronautical school for the United States Navy.

The new ground school in aeronautics is the first institution of the kind to be established by the United States Navy. For six or seven weeks there has been a school at "Tech" for the prospective flying men of the Signal Service of the United States Army.

The head of the civil faculty of the new school is Professor C. H. Peabody, while the naval administration will be cared for by an officer not as yet named. A group of thirty-three young men will be sent to the institute, to be followed on successive Mondays by an equal number of men till a maximum of two or three hundred is reached. For the first three weeks the students will engage in intensive drill, which with naval men includes exercises in the Charles River Basin as well as infantry evolutions on land. Following this there will be five weeks of intensive study of the fundamentals, mechanical and mathematical, suitable for the education of an aeronaut. Here the emphasis will be placed on the hydro-aeroplane and its accessories, but will, of course, include engine study of all the modern types, meteorology, bombs and bombing, aspects of land and sea from a height, machine gun operating, wireless and signalling, and the flying machines themselves, of which there will be a number of patterns for dissection and reconstructions. At the end of the eight weeks the students will be ready to go into the air and will be detailed to some flying school for practical experience.

Four Aviators Going from Marblehead Camp to France

Marblehead—Drummond B. Cannon and Francis Draper Crosby of New York, R. Nobles Estes of Providence and Harry W. Seeley of Connecticut, members of the aviation division in training here, were given an honorable discharge to permit them to go to France immediately to serve in the Lafayette flying squadron.

Insurance For Aviators

The National Advisory Committee for Aeronautics authorizes the following:

The National Advisory Committee for Aeronautics has addressed letters to the Secretary of War, the Navy and the Treasury and to the chairmen of the Senate and House Military and Naval Affairs Committees and other members of Congress suggesting the probable necessity or advisability of the Government undertaking at an early date the insurance of aviators, or some form of financial co-operation with the insurance companies that will enable them to write insurance at rates possible to the insured, and under conditions which will protect the companies against war losses that may seriously affect their solvency.

This action is in a measure the result of a report submitted to this committee by the chairman of the Committee of Five on Statistics, of the Bureau of Personal Accident and Health Underwriters, wherein it was stated that it was impossible for the insurance companies to write accident insurance for aviators. A number of the life insurance companies, however, have agreed to write life insurance for aviators at reasonable extra premiums.

Inventory of Automotive Factories Now in Progress

The automotive committee of the Council of National Defense has inaugurated a comprehensive industrial inventory of the automotive industries, including automobile, airplane and watercraft factories, to make available to the Government all possible information regarding their manufacturing facilities and the possibilities of expansion for Government work. The inventory is being taken by the industrial inventory section of the Council of National Defense and the first replies already have come in. The work will be completed probably within two or three weeks.

The undertaking was inspired by the approaching great demand on the industries for aeroplane engines, motor trucks, tractors and motor boats for war purposes.

The new blanks being sent out are much simpler than those formerly used, as experience in war needs has demonstrated the superfluity of some of the details asked for last year.

The inventory will give the Government authorities exact information as to just what can be expected from each plant, and will also give a thorough insight into the requirements of the industries in the way of additional labor and machinery, making it possible to plan accurately and intelligently for expansion.

Bernard H. Sandler's Good Work

Mr. Bernard H. Sandler, who was appointed by the Aero Club of America to arrange for the Club's activities and co-operation in taking the military state census, has reported the work accomplished and submitted the following letter from Mr. C. E. Whitmore, of the City Club, who had the registration in charge:

"Mr. Bernard H. Sandler,
Representative of the Aero Club of America,
297 Madison Ave., New York.
Dear Sir:

I wish to express to you and to the Aero Club my deep appreciation of the able assistance you rendered to the Military State Census in the 27th Assembly District by the establishment of Station 30.

Mr. Daniel tells me that the registration from our District was the largest in the city. The attached copy of his tabulation will probably interest you.

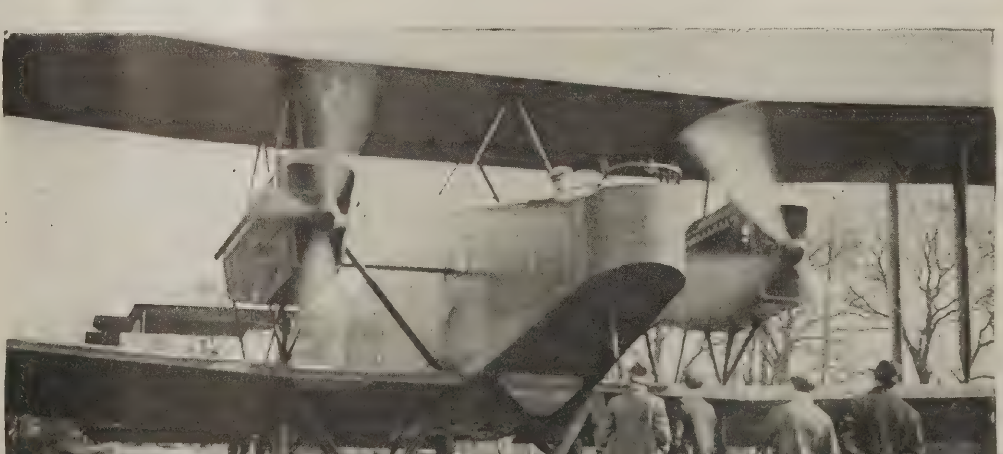
May I express the hope that we may again co-operate, should the occasion arise wherein we can be of service to our State and country.

Very sincerely yours,
(Signed) C. E. WHITMORE,
Supervisor."

Flying School in Cape May

Cape May, N. J., July 20.—A sub-committee of the Committee on Naval Affairs of the United States Senate, made up of Senators Robert F. Broussard of Louisiana, Miles Poindexter of Washington, and James D. Phelan of California, have decided to recommend the purchase by the Government of fifty-eight acres in Cap May for an aviation school.

This word has been sent from Washington, and the Cape May Real Estate Company, the owner, is arranging for the transfer.



The British Handley-Page gun and bombing plane which recently arrived in this country. It is equipped with two 280 h.p. Rolls-Royce motors and has mountings for three guns. The top wing is 98 feet wide, the lower wing 65 feet. It has carried twenty-one passengers

Aero Club of America Appoints Foreign Service Committee

To keep a complete record and roster of all American fliers in Europe and rendering such energetic aid to aviators as is possible, the Aero Club of America has appointed a special Foreign Service Committee, of which the American Ambassador in Paris, Mr. William G. Sharp, is the chairman.

Mr. Evert Jensen Wendell, a member of the Board of Governors of the Club, and Mr. Augustus Post, Secretary of the Board of Governors of the Club, will sail for Europe in a few days, to assist in the formation of the Foreign Service Committee, the membership of which will include the following: Ambassador William G. Sharp, Sidney B. Veit, Dr. Edmund L. Gros, Vice-President Lafayette Corps; Robert Bliss, Secretary American Legation; Dr. A. L. Hipwell, William S. Hogan, William Thaw, of the Lafayette Corps; Captain James E. Miller, First Reserve Aero Squadron, U. S. Army, and G. F. Campbell Wood.

The scope and duties of this Committee, which is to act as a paternal organization, to look after the welfare of our fliers in Europe, will be as follows:

1. To keep a complete record and roster of all American fliers in Europe in whatever arm or capacity they may be.
2. To record each man, whether in the service, out of the service, wounded, missing, prisoner, or killed, and to keep the Club informed thereof by letter or cable.
3. To inform the Club of the needs of American aviators.
4. To disburse the funds from time to time put at their disposal by the Club.
5. For rendering such energetical aid to aviators in cases which are not otherwise provided for as upon their recommendation the Club shall authorize them to provide.

Ground Schools for Aviation Students Proving Effective

The War Department authorizes the following:

Maj. Hiram Bingham, of the Aviation Division of the Army, has returned from a tour of inspection and has seen most of his 1,142 kindergarten fliers hard at work in the ground schools now in operation on college campuses throughout the country.

Maj. Bingham is the father of this type of school in the United States, and the course of training adopted has the enthusiastic endorsement of experienced foreign aviators who have seen the work. English and French fliers are thoroughly alive to the importance of theoretical instruction as the first step toward learning to fly. Many of the most serious mistakes made by foreign flotillas at the early part of the present war were due to minimizing the importance of absolute technique in aerial fighting.

As the war progressed, the art of code signaling from the air was developed with the same rapidity that was required in every form of attack and defense. So perfect became the communication between the aviators and the batteries that fire control from the air has now become an exact science.

Most of the aerial observation in modern battles is taken from a height of about 7,000 feet, and the study of accuracy from this height comprises one of the most important—and certainly one of the most popular—courses given in our ground schools. The idea is to give the student perched at the top of a ladder the picture of the Belgian battle ground as it would appear to one looking down from a height of 7,000 feet. The student's perch is 16 feet from the ground, and the picture covers a surface of 16 square feet and has been drawn from aviation photography. The cadet works with the key of a radio outfit, which for convenience gives forth visible electric flashes governed by the standard code. The instructor stands at a switch board from which at will he can flash little electric lights on any part of the map. Taking note of these imaginary explosions, the young aviator ticks off instructions to the "batteries."

It is the idea in modern air fighting that the aviator shall be something far more useful than a mere flying man. The ordinary aviator bears the same relation to an air fighter that a chauffeur bears to the driver of an armored motor car. Before he can even think of fighting the military aviator must know his machine and be as familiar with all the tricks of riding it as the old-fashioned dispatch rider was with his horse.

The up-to-date pilot must know how to groom his machine and to attend to every detail of its inner workings. He must be expert to the point where his machine is only secondary and he can give all his attention to his military problem. In the experience of England it has been found that former officers of Cavalry and Artillery often make the best aviation officers, as an able cavalryman is an expert at reconnaissance and artillerymen are trained in all the subtle tricks of gunfire.

Army and Navy News

The following-named officers of the Aviation Section, Signal Officers' Reserve Corps, will proceed to Fort Wood, N. Y., and report in person to Capt. James E. Miller, Aviation Section, Signal Officers' Reserve Corps, for assignment to duty: First Lieuts. Daniel R. Noyes, Joseph H. Stevenson, Hobart A. H. Baker, Frederick T. Blakeman, Alexander B. Thaw, 2d, Edwin M. Post, jr., and Daniel P. Morse, jr.

Capt. Harold S. Martin, junior military aviator, Signal Corps, will proceed to Buffalo, N. Y., and Camp Borden, Toronto, Canada, for temporary duty in connection with the aviation service of the Army, and upon the completion thereof will return to his proper station.

British Aerial Expert Coming

The National Advisory Committee for Aeronautics makes the following announcement:

Arrangements have been made for Mr. George Thomson, son of Sir J. J. Thomson, of Cambridge, England, to visit the United States as a representative of the British air board. His visit will have a special significance in reference to the development of designs of apparatus and instruments for scientific research and experimental work in connection with aeronautics, both for the National Advisory Committee for Aeronautics and the War and Navy Departments. It is expected that he will bring to the United States the latest designs and specifications for aeronautic instruments and apparatus and full information in reference to the methods of scientific research developed in England in recent years.

Vincent Leaves Packard During War

Detroit, July 17—J. G. Vincent, vice-president of engineering, Packard Motor Car Co., has left the Packard company for the period of the war, and is giving all his attention to aviation work in Washington. Mr. Vincent has been working with the Aviation Signal Corps.

A group of Army students at one of the training fields

Aeroplane Materials Standards Committee

New York—A meeting to start standardization of materials used in parts of aeroplanes other than the engine was held July 17, the following being present:

F. G. Diffin, Chairman, Aircraft Eng. Div., Washington, D. C.; W. H. Bassett, American Brass Co., Waterbury, Conn.; H. L. Greene, Wright-Martin Aircraft Corp., New York; H. J. Horn, John A. Roebling's Sons Co., Trenton, N. J.; Charles M. Manly, Curtiss Aeroplane Co., Buffalo, N. Y.; John A. Mathews, Halcomb Steel Co., Syracuse, N. Y.; M. W. Hanks, Standards Manager, S. A. E., N. Y.

Comments made by Mr. Diffin revealed the organization of the Advisory Committee for Aeroplane Materials, Specifications and Inspection. The general committee will come under Mr. Souther of the Aircraft Engineering Division. Mr. George W. Mixter will have general charge, Mr. B. D. Gray will have materials exclusive of metals and Mr. F. G. Diffin will have charge of metals. The scope of operation of these committees will probably include inspection and testing of materials for the allies.

The outline of procedure of this committee will be to formulate suitable metal specifications by the co-operation in each field of the best talent of both American and foreign engineers. The metals are to be produced by the mills in accordance with these specifications, but should there be an occasional deviation due to natural causes of production it is not the intent to reject that particular run of metal but to consign it to salvage with specific markings to indicate its composition. It may then be diverted to uses other than originally intended or a specific heat treatment prescribed which will ultimately bring its physical properties up to standard. In this manner production can be hastened and all materials can be advantageously used. The Government thus certifies to the composition of the material leaving the mills.

A sub-committee on steel, consisting of Dr. J. A. Mathews, chairman, Mr. H. L. Greene and Mr. C. M. Manly, is to make complete investigation of both American and foreign aeronautic steels and formulate a recommendation at the meeting of the sub-committee on steel to be held in Syracuse, July 24.

The next meeting of the Sub-committee on Steel will be held in Syracuse at the Halcomb Steel plant, July 24, at 10 a. m.

The next meeting of the whole committee will be held in New York, S. A. E. headquarters, July 30, at 10 a. m.

Flying Course in France

Paris, July 20.—The United States is making preparations here for a great American aviation force. The General Staff estimates that the ratio of five machines to the enemy's one is needed to maintain complete mastery of the air by the Allies.

It is announced officially that all aviators trained in America must go through another course of instruction in France. The period of this training will depend on the individual. The instruction will consist of flying in battle formation, dropping bombs, studying maps and learning other military tactics required at the front.

High British aviation officials will co-operate with the French in teaching military methods to the American fliers. The American aviation schools are preparing to receive a large number of men.

An Interesting Communication

Mr. Alan R. Hawley, President of the Aero Club of America, has received the following interesting letter from "An American":

"Won't you please do everything in your power to get the aeroplanes moving fast, so we can win the war. Get every man, woman and child busy; get the heads in Washington busy; try and get the proper party to collect funds in restaurants, theaters, cabarets, etc., from a nickel up. Get all the factories busy, the electric plants to make the parts, the munition plants, **everything.** We got the Liberty Loan. We'll get the Red Cross money. Let us get the money for aviation. What's the use of sending our boys to the battle fields to be killed and slaughtered. I hear they have 7,000,000 men on the field now. Let the aeroplane win the war. Get them by the thousands, and after you get plenty on the other side (warn Germany) give her three days to surrender (keep this under your hat till the right time); then with your aeroplanes drop bombs and dynamite on her munition plants, on everything, wipe her off the earth like you would a disease. If Germany is the size of Texas, **why** can't we clean her up. They show us no pity. Killing everybody, they have had their joke over the submarine. Let's have ours over the aeroplane.

You can do it, Mr. Hawley, because you are a good American, and know how to go at it. Let it be AMERICA OVER ALL. Push it to a finish. Some good American must —why not you? And let us all have a good laugh. We need it. WE MUST WIN.

"AN AMERICAN."

Army and Navy News

Lieutenant Ducos, of the French Aviation Corps has arrived in San Antonio and reported at Department Headquarters. Lieutenant Ducos recently arrived from France and is said to be one of their most proficient flyers. He is now stationed at Camp Kelly as assistant department aviation officer and will be attached to the Aviation School.

Capts. Carl Spatz and Thomas J. Hanley, jr., S. C., to Rantoul, Ill., Aviation School, for duty. (July 10, War D.)

Capt. Lewis H. Brereton, S. C., to duty in office of the Chief Signal Officer. (July 10, War D.)

First Lieut. Delos C. Emmons, Av. Sec., S. C., to San Francisco as aeronautical officer, War D. (July 14, War D.)

Capt. J. B. McCalley and 1st Lieut. C. D. Winslow, Av. Sec., S. O. R. C., to Wilbur Wright Field, Fairfield, Ohio, Aviation School, for duty. (July 13, War D.)

First Lieuts. Frank N. Cordner and Alfred P. Bourguardez, S. O. R. C., to duty at Essington, Pa., Aviation Station. (July 10, War D.)

First lieutenants of S. O. R. C. to duty and report in person to commanding general S. D., for assignment to duty: Samuel B. Eckert, Morton L. Newhall, John A. Hambelton, Paul V. Burwell and Lloyd L. Harvey. (July 10, War D.)

First Lieut. Tebe L. Creighton, Av. Sec., S. O. R. C., to San Francisco for duty. (July 10, War D.)

First Lieut. R. M. Olyphant, Jr., Av. Sec., S. O. R. C., to 1st Aero Reserve Squadron, Mineola, Long Island, N. Y., for duty. (July 13, War D.)

First lieutenants of Av. Sec., S. O. R. C., to Fort Wood, N. Y., for duty: D. R. Noyes, J. H. Stevenson, H. A. H. Baker, F. T. Blakeman, A. B. Thaw 2d, E. M. Post, jr., and D. P. Morse, jr. (July 13, War D.)

First Lieut. Quentin Roosevelt, Av. Sec., S. O. R. C., to Fort Wood, N. Y., for duty. (July 13, War D.)

Army Orders

First Lieut. Charles J. Glidden, Aviation Section, Signal Officers' Reserve Corps, is relieved from duty at the United States Army Balloon School, Fort Omaha, Nebr., and will proceed to this city and report in person to the Chief Signal Officer of the Army for temporary duty, and upon the completion thereof will proceed to Boston, Mass., and report in person to the commanding general, Northeastern Department, for assignment to duty as aeronautical officer of that department.

First Lieut. Henry H. Simons, aviation section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding officer, Signal Corps Aviation School, Mineola, Long Island, N. Y., for assignment to duty.

First Lieut. Frank M. Kennedy, aviation section, Signal Corps, will proceed from Fort Benjamin Harrison, Ind., to Fort Omaha, Nebr., and report in person to the commanding officer, United States Army Balloon School, for duty at that school.

The following-named officers, now detailed in the aviation section, Signal Corps, are rated as junior military aviators: Capts. Thurman H. Bane and Guy L. Gearhart; First Lieuts. Claude K. Rhinehardt, Thorne Deuel, Jr., Harvey B. S. Burwell, Warren P. Jernigan, Norman J. Boots, William P. Peebles, Norman W. Peek, and John E. Rossell.

First Lieut. Paul Pleiss, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Fort Omaha, Nebr., and report in person to the commanding officer, United States Army Balloon School, for temporary duty, and upon the completion thereof will proceed to Washington, D. C., and report in person to the Chief Signal Officer of the army for assignment to duty.

Maj. William H. H. Hutton, Jr., Quartermaster Officers' Reserve Corps will make not to exceed two visits to Indianapolis, Ind., and Dayton, Ohio, on official business pertaining to aeronautics of the army, and upon the completion of the duty enjoined will return to his proper station after each visit.

Capt. Harrison H. C. Richards, junior military aviator, Signal Corps, is relieved from his present duties and will proceed to Atlanta, Ga., and assume charge of cadet training at the Georgia School of Technology at that place.

Mineloa Aviation Field Y. M. C. A. Dedicated

The Mineola Aviation Field Y. M. C. A. was dedicated on July 18th. Capt. W. G. Kilner, who is in charge of the school's activities presided, and Mr. Augustus Post, of the Aero Club of America, delivered the address of dedication. Mr. W. D. Boyle, general field secretary of the Y. M. C. A. War Committee, W. K. Vanderbilt, Jr., Mr. and Mrs. Whitney, from Garden City, and many prominent ladies from Hempstead and Mineola attended the function.

Georgia Tech School Opens

The aviation school at Georgia Tech, which was scheduled to open last week, will begin work this week, according to the announcement of Prof. H. P. Wood, in charge of the school. Fifty students will be on hand, drawn from the officers' camps at McPherson and Oglethorpe. Thereafter the number will be increased at the rate of twenty-five a week until the school is filled. Altogether about two hundred men will be placed under instruction, according to present plans. They will all be taken from the two Georgia student camps.

Captain H. H. C. Richards, of the signal corps, has been detailed to command the school. He will be assisted by a staff of about twenty-five instructors, a number of them officers of the regular army.

Washington.—Fifteen men from the officers' training camp at Fort Myer were designated last week to go to the Canadian branch of the Royal British Flying School at Toronto for training as officers of the great airship fleet the United States is building. They have left camp.

The names of eleven men were sent to the War Department in response to an inquiry for information regarding those who have seen service in France.

The fifteen men designated for the aviation school at Toronto are Z. R. Miller, Princeton, N. J.; Horace Lake, Washington; Lawrence L. Smart, Baltimore; A. L. Grimme, New Brunswick, N. J.; Lawrence Hoover, Washington; J. H. Ackerman, Plainfield, N. Y.; Harold G. Schoemaker and Jesse O. Creech, Washington; Lawrence Roberts, Burlington, Del.; Eugene F. Muller, Paterson, N. J.; Donald Hudson, Washington; Harry Jenkins, Jr., Elizabeth, N. J.; Cuthbert Tunstall, Norfolk, Va.; Edward Donavan, Washington, and S. H. Dorr, Jr., Nutley, N. J.

Standard Roller Bearing Opens New England Office

An event of interest to New England automobile owners in general and to dealers and garage men in particular, is the opening this week of a Boston branch house of the service sales department of the Standard Roller Bearing Company, of Philadelphia, which will be headquarters in New England territory for all their products.

Attractive quarters have been secured at 163 Massachusetts Avenue in the centre of Boston's "automobile accessory row" and this new store will be in charge of Joseph R. MacCollum well known to the trade, having been for several years purchasing agent for the Packard Motor Car Company of Boston. Mr. MacCollum spent considerable time at the factory of the S. R. B. Company, to familiarize himself with its different products and the many processes of manufacture covering same, so that patrons will be assured of first hand information and prompt service.

Fliers Leave for France

The following recruits for the Lafayette Flying Corps have sailed for France: William Soule Clarke, 336 West Seventy-second Street, N. Y. C.; John Jay Van Schaack, Hartford, Conn.; Charles Ward Hall, Jr., Larchmont; George William Eypper, Montclair, N. J., and Ellison Converse Boggs, Miami, Fla.

Another who recently sailed to join the American fliers with the French army is Henry Elmer Stickney, of Rutland, Vt. He left college to study aviation, bought a wrecked aeroplane with his savings and repaired it, so that he could learn to fly.

Meredith Now an Aviator

James Edward Meredith, middle distance runner extraordinary, is now a regular aviator. Word has come from Ithaca, N. Y., where the greatest of all half-milers has been studying the art of flying, to the effect that Ted made his first flight in a war machine a few days ago and will soon be tearing off a couple of air trips every day.

Since he went to Ithaca Meredith has been studying the mechanical part of the aeroplane, and the announcement that he has made his first flight comes as a bit of a surprise to Ted's friends, who did not expect to hear of his being in the air before the early fall. In a very few days Meredith, along with other advanced students, will be sent to the government aviation field at Essington, near Philadelphia, where he will be developed into a finished flier. Ted has written to a local friend that in spite of his aviation work he may be seen in athletic competition during the late summer. He believes that his hours at Essington will allow him to get into fine condition again. The regular outdoor life at Ithaca has already hardened Meredith, and he believes that with a few week's training on the Franklin Field track he could run fast again.

As a student aviator at Essington, Meredith, thought he would have hard hours, in a way, would have much time to himself in the middle of the day. Morning flights take place at about 5 A. M., and usually last until about 8. In the afternoon the embryo airmen are usually sent up at about 4.30, this practice lasting for two hours. This arrangement gives the students practically the whole day to themselves, and as they are required to go to bed soon after dinner is over they are given a reasonable amount of freedom during the daytime.

Military Sketching and Map Reading.

To the student of aviation who is now attempting to master the essentials of his training along practical military lines, map sketching and reading is not one of the least considerations.

Capt. Barnes' little treatise, "Elements of Military Sketching and Map Reading," was undertaken with a view to providing a textbook suitable for beginners in the subject of Military Sketching. To the original book, however, have been added chapters on Map Reading and Landscape Sketching.

Brief though its text, it is concisely written and covers in a very practical manner the fundamentals of map sketching and reading, from the scale representation, signs and abbreviations used, orientation, etc., to the rules laid down for the actual drawing of the maps themselves.

It is an interesting study, and Capt. Barnes' exposition of the subject does not detract from its interest. ELEMENTS OF MILITARY SKETCHING AND MAP READING, by Capt. John B. Barnes. 75 cents. Obtainable through the Aeronautic Library, 280 Madison Avenue.

Gas and Oil Engines.

The major topics of "Gas and Oil Engines and Gas Producers," by Marks and McDewell, are summed up in the title of this book. In Part I the relative values of external and internal combustion engines are set forth, with a somewhat detailed account of the thermodynamics of the latter, using as illustrations the Otto and Diesel cycles. Fuels and fuel mixtures, with their mixing devices, are also discussed.

There is a chapter on Modern Internal Combustion Engines, which treats very comprehensively on carburation and ignition in both the automobile and aeronautical engines.

Valves and Valve Gears are also included, with a final chapter on Gas Engine Operation.

Part II is devoted entirely to the problems of Gas Production, and is well illustrated with photographs and diagrams. In fact, the book throughout is fully illustrated and contains many interesting tables. GAS AND OIL ENGINES AND GAS PRODUCERS, by Marks and McDewell. $2.00. Obtainable through the Aeronautic Library, 280 Madison Avenue.

Members of the Aeronautic Station at Marblehead, Mass., who leave shortly to join the Latayette Flying Corps

AIR SERVICE HAS RIGHT OF WAY

THE Air Service has the right of way and the air program is to be rushed through as fast as possible.

There is a general appreciation everywhere that it is best to make mistakes in speedy action than to lose a day—since losing a day means the loss of about 5,000 Allied soldiers and expenditures and destruction to the amount of about $500,000,000.

Financing of Aeronautic Manufacturers Necessary

We printed recently an outline of the seven important factors in quantity production. There must be added an eighth factor—financing of aeronautic manufacturers by the Government.

This is necessary to avoid the evil of manufacturers having to borrow money at high interest rates to fill the Government orders. If they have to borrow the Government will have to pay the high interest rates.

No manufacturer of aeronautic products can be expected to finance orders amounting to millions of dollars—no more than naval constructors are expected to finance contracts of ships. The aeronautic manufacturers should be financed more or less on the same basis as ship builders. How it is done is not important, but it is vitally important that it should be done.

Council of National Defense Has Power to Arrange for Financing

The Council of National Defense seems to have the necessary power to arrange for the financing of firms. The act which created the Council is very broad and it would seem that between that act and the broad provisions made in the so-called Hay bill last year, the Secretary of War, who is also the Chairman of the Council of National Defense, should not need additional power to arrange for financing the manufacturers.

Aircraft Production Board and Aeronautic Division Going Ahead At Full Speed

The aircraft Production Board and the Aeronautic Division, Signal Corps, are ready to go ahead—as a matter of fact, they have been going ahead at full speed.

Acting with the almost unlimited power and authority which it has through its being the aeronautic branch of the Council of National Defense, the Aircraft Production Board has done some very energetic and telling work.

It is fortunate for the Signal Corps and for the country as a whole that the Aircraft Production Board exists in this crucial period of time when prompt action is necessary. Without the Board the Signal Corps would have had to await official authorizations on every aspect of the project, which would probably have taken months to get, because the advocate general's office is just as jammed with pressing business as every other office.

When a military officer acts without most complete authorization he becomes subject to all kind of trouble. The civilian executive is responsible to the country and is judged from the standpoint of results, rather than from the methods adopted in getting the results.

The Air Service Organization

The Intelligence Division of the Aviation Section Signal Corps has issued a very comprehensive plan of organization, which is reproduced herewith. In various passages the aircraft Production Board is referred to as an organization of purely advisory nature and without power to act, or it is stated that a given Division "may" consult with the Board. This overlooks the almost unlimtied power of the Council of National Defense and unnecessarily gives the impression that the Divisions do not co-operate closely with the Board. This should not be, and we hope that future bulletins from the Intelligence Division will state clearly that there is the closest of co-operation between the Aviation Section and the Board. The statement issued by the Intelligence Division reads as follows:

Aeronautical work in the Army is conducted directly by the Signal Corps, whether such lies under the heading "Aviation" or "Aerostation."

The Aviation Section (*) of the Signal Corps is composed, originally, of officers and enlisted men of the Regular Army, limited by law to a definite number.

Additional personnel is provided through the Signal Officers' Reserve Corps, the Signal Enlisted Reserve Corps, and the employment of civilians in instructive, advisory, administrative or other capacities.

Civilians may be employed (1) as such; (2) by passing standard physical and mental examinations and going through the routine of joining the Signal Officers' Reserve Corps, in which event, if satisfactory, they may be given commissions therein commensurate in grade with their attainments and duties, as follows: (a) Non-flying duty; (b) Flying duty or (3) by enlistment in the Signal Enlisted Reserve Corps.

The aeronautical work in the Signal Corps is supplemented by (1) the co-operation of the Navy in the Joint Army and Navy Board of Aero Cognizance, (2) the Joint Army and Navy Board for Rigid Dirigibles, (3) and Joint Army and Navy Board for Design and Specifications, which boards are responsible to the Secretary of War and the Secretary of the Navy respectively; and by co-operation of the (4) Aircraft Production Board (a subsidiary of the Council of National Defense, and the (5) National Advisory Committee for Aeronautics, which latter reports to the President of the United States.

The director of the Army aeronautical work is the Chief Signal Officer, acting through his Executive Officer.

The work is divided between various divisions, sections and sub-sections. Following are some notes on the duties of these various branches.

1. Aeroplane Division

Organization and Training Section.—This Section has to do with the organization of aviation school squadrons and of standard aero squadrons, the latter composed of graduated Reserve Military Aviators.** It has nothing to do with training of men for aerostatic work, which is handled by the Balloon Division.

Graduates of the Schools of Military Aeronautics (ground schools) are assigned through the Aero Personnel Division in co-operation with the O. & T. Section, to the various aviation school squadrons for instruction in actual flying. From this point on the flying students are in charge of the O. & T. Section.

Sixteen of these school squadrons at the present time are operating. Belleville is to be in operation August 15th.

Following is a list of the location of aviation school squadrons organized and to be organized in the near future. As time goes on, doubtless this schedule will be extended.

Mineola, N. Y.—now operating.
Mt. Clemens, Mich. (Selfridge Field)—operating.
Fairfield, O. (Wilbur Wright Field)—operating.
Rantoul, Ills. (Chanut Field)—operating.
So. Mississippi Valley—under investigation.
San Antonio, Tex.—operating.
San Diego, Calif.—now operating.
Belleville, Ills.—in operation August 15th.
One station to be in Rocky Mountain Region.
Fort Sill, Okla. (advanced school)—being established.

At the above schools training is done with as much rapidity as possible. At the conclusion of from fifteen to twenty-five hours' flying, it is expected students will be able to pass the tests for certificates as Reserve Military Aviators.

While undergoing this flying instruction, the pupil is required to study radio, gunnery, photography, motors and aeronautical engineering. This study is practical; the student handling and operating every instrument, assembling and dis-assembling engines, and the construction and repair of aeroplanes to the extent that he must assemble, dis-assemble, line-up, etc. In the gunnery instruction, for instance, the student uses a machine in which a gun is mounted and is given target practice at objects moving in the air.

Upon receiving their certificates, these flying students are commissioned as First Lieutenants, Signal Officers' Reserve Corps, Aviation Section, and when on duty involving frequent or continuous flying, receive twenty-five per cent increase in pay. The base pay is $2,000 a year. When on foreign duty ten per cent increase on the base pay is allowed. Quarters are also furnished.

Standard aero squadrons of the Army are formed at the aviation school squadrons. The flying and enlisted personnel for these squadrons are furnished from these flying schools. The officers, of course, are Reserve Military Aviators by this time, though some may be Junior Military Aviators. The enlisted men are of the Enlisted Reserve Corps, or of the Regular Army.

These aero squadrons, thus formed, will be fully equipped, save as to aeroplanes, and transported to England or France for advanced training.

These graduated aviators (R. M. A.'s) may also be sent to complete the complement of aero squadrons already in process of formation or partially filled, to be maintained at certain points.

Aero squadrons are located now at the following places:

Home	Overseas
Columbus, N. M.	Fort Mills, Corregidor, P. I.
San Antonio, Tex.	Honolulu
Mt. Clemens, Mich.	Ancon, Canal Zone
Rantoul, Ills.	
Fairfield, O.	
Mineola, N. Y. (Reserve)	
Essington, Pa. (Reserve)	

The foregoing, with two exceptions, are Regular Army aero squadrons as distinct from the Reserve Aero Squadrons which will be composed of Reserve Military Aviators solely.

It is not at the present time expected to utilize civilian training schools as it is planned that the aviation school squadrons will continue to be amply prepared to handle all flying instruction. No civilian schools are now in operation in connection with Army training.

Applications from officers in the Regular Army for transfer to flying duty are also received and preliminarily acted upon here and then passed to the Personnel Division. If all conditions are met, officers are sent to one of the aviation school squadrons for flying instruction. These officers, when qualified, are rated as Junior Military Aviators and they receive fifty per cent increase in pay when on flying duty. A Junior Military Aviator, having served continuously three years as such on flying duty may obtain the title of Military Aviator and be then entitled to seventy-five per cent increase in pay when on duty involving frequent or continuous flying. Foreign service adds ten per cent, as usual.

The Organization and Training Section, also, handles original applications for commissions in the S. O. R. C. from civilians, Regular Army or National Guard officers and men, needed as supply, engineer or field-inspector officers. Opportunity is afforded by personal interview to obtain first-hand knowledge of the particular attainments of each man. If preliminary investigation is satisfactory, the applicant fills out his blank and is turned over to the Personnel Division, which attends to the routine of physical and mental examination. Upon the obtaining of his commission he is assigned to such place as his services are required.

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*It will be noted in printed matter of the Signal Corps, Aviation Section, that the title "Aviation Section" is used to embrace all aeronautical work in the Army. Since the publication of these pamphlets, the scope has been altered in accordance with this memorandum, as will appear obvious

**There are but a few officers with the title "Military Aviator" and "Junior Military Aviator." These are in administrative positions. Practically the entire new flying personnel is to be composed of Reserve Military Aviators.

Equipment Section.—This Section makes out all purchase requests for equipment for all aero units, except for local purchases. It adjusts differences between the manufacturers and the Government relative to equipment and determines what equipment shall be shipped to new organizations.

Intelligence Section.—The functions of the Intelligence Section are, broadly, the collection and filling of data of every nature and from all sources, relating to military aeronautics and aeronautical engineering and the making of such digests and publications as may be advisable to those interested for confidential and public information.

2.—Aircraft Engineering Division

The Aircraft Engineering Division, also reporting to the Chief Signal Officer, is divided into the following departments, in charge of an officer and a staff of commissioned assistants and civilian engineers and their assistants.

Aeroplane Section.—In this department is conducted work incident to status, design, specifications for aeroplanes, radio equipment, photographic equipment, instruments and accessories. The testing of units of apparatus, instrumental apparatus, and other, is conducted under the supervision of the officer in charge and commissioned assistants of this department.

Power Plant Section.—In this department is conducted work (a) incident to the investigation and testing of new aircraft engine units in process of development by various manufacturers; (b) incident to standardizing of power plant parts, such as propeller bulbs, magneto, couplings, fittings, etc.: (c) incident to special investigations in connection with engine manufacture outside of the field of members of the Inspection Section.

Inspection Section.—This department, although not fully organized, will involve the division of the country into districts, each district in charge of a commissioned ojfficer, reporting to the Officer in Charge of the Inspection Department. In each district, under the Officer in Charge, will be a commissioned officer in charge of more important factories, with corps of civilian engineers or others qualified for the work. The insepction involves all material and manufactured articles in connection with the Air Service of the Army.

Transport Section.—Within this department the special requirements of transport service incident to both heavier-than-air and lighter-than-air squadron operation are considered, and means adopted whereby the manufacture of trucks and special equipment to meet all requirements are produced.

Design and Experimentation Section.—This department involves the conduct at Langley Field aeronautical proving ground, of about two thousand acres, near Hampton, Va., of all experiments and tests on (a) aeroplanes of various types; (b) aeroplane engines in production, in development, or of distinctly new types; (c) radio equipment of various types and for various uses in connection with aircraft operation; (d) ordnance—tests under this heading are carried on in conjunction with and under the supervision of the Chief of Ordnance, U. S. Army; (e) photograph experiments with all types of photographic apparatus for use in aeroplanes; (f) instruments and accessories.

All tests and experiments are carried out on conditions which simulate, as far as possible, the conditions met in actual service.

Langley Field, when completed, will include among other items, the following: administration building, hospital, quartermaster storehouse, commissary buildings, post exchange building, power house, 3 aeroplane hangar units, 2 seaplane hangar units, boat house, garage, truck shed, 2 barracks, laboratory, aeroplane construction shop, machine shop, foundry, three 200-foot observation towers, wind channel building, dynamometer building, engine test house and houses for commissioned, non-commissioned officers and civilians.

3.—Finance & Supply Division

The functions of this Division are the purchase of aircraft material of every kind in connection with aeronautics in the Signal Corps, and the payment therefor.

4.—Aero Personnel Division

The duties of the Aero Personnel Division consist in matters affecting the commissioned and enlisted men of the Aviation Section of the Signal Corps, which may be more conveniently termed the Army Air Service. All communications to the Chief Signal Officer, or higher authority, that are concerned with the subject of aviation personnel must pass through this Division, except when such communications deal with civilian employes.

The personnel of the Army Air Service comprises the following groups:

(a) Enlisted men of the Regular Army.

(b) Signal Enlisted Reserve* (throughout this article referred to as "Enlisted Reserve Proper").

(c) Men (flying duty) enlisted temporarily in the Signal Enlisted Reserve in order to obtain training for a commission in the Aviation Section of the Signal Officers' Reserve Corps. (Throughout this article referred to as "Enlisted Reserve.")

(d) Reserve officers (flying duty).

(e) Reserve officers (non-flying duty).

(f) Officers (of Regular Army).

The Aero Personnel Division is also concerned with two other groups of men:

(g) Enlisted applicants of the Regular Army for transfer to the Air Service.

(h) Commissioned applicants of the Regular Army for detail to the Air Service.

(a) Present provisions in regard to the first of these groups continue as now prescribed by law and Army regulations. The Aero Personnel Division has charge of the records of enlisted men of the Regular Army.

(b) The purpose of the "Enlisted Reserve Proper" has been to have a body of trained mechanicians, machinists, electricians, chauffeurs and other qualified men, who may be quickly called in time of need. Cards giving the home addresses and information about the enlistments of such reservists are kept in the Aero Personnel Division. Similar information is in the service record of each reservist, in the hands of the department commander in whose territorial jurisdiction he resides. No more enlistments in this group as reservists are made at present, there being no desirability during war-time in increasing the number of reserves not on active duty. The entire personnel of this group is at the date of writing being called into active service by the department commanders immediately upon enlistment. They are assigned to aviation stations and placed on training.

(c) The enlisted reservists who are applicants for commissions as reserve officers, flying duty, and are enlisted in the Signal Enlisted Reserve Corps simply for the purpose of preliminary training prior to receiving their commissions, comprise an extremely important group. From their numbers will come almost exclusively the aviators of the Army Air Service. The procedure in regard to the enlistment of these men is in the hands of the Aero Personnel Division. All applicants for commission in the Aviation Section of the Signal Officers' Reserve Corps must forward their applications to the Aero Personnel Division for approval or disapproval. If the application is approved, its sender is then given an examination to determine his physical condition, and another to test his moral, professional, and educational qualifications for a commission. Boards to give the complete examinations are situated at each of the Schools of Military Aeronautics, at the several Signal Corps flying schools in the United States and Washington.

If the candidate is successful in passing these examinations, he is re-examined with the view of enlistment as private, first class, in the Signal Enlisted Reserve, and is then either sent home with a certificate of enlistment to await further orders, or sent immediately to one of the ground schools (Schools of Military Aeronautics) for instruction.

From this time until the receipt of his commission the candidate is under the jurisdiction of, first, the Schools of Military Aeronautics Division, and later of the Organization and Training Division—the Aero Personnel Division being simply concerned with keeping his military record.

On recommendation of the Schools of Military Aeronautics Division, the Aero Personnel Division asks for the transfer to the ground schools of suitable students on duty at the Federal Reserve Officers' Training Camps. Such requests, if recommended, are made weekly.

(d) Upon successful completion of the flying school course, the candidate is commissioned as a reserve officer, whereon his relation to the Aero Personnel Division becomes like that of a regular officer of the Air Service.

Competent civilian flyers who pass the physical and mental examinations and are satisfactory otherwise, may be at once commissioned in the Signal Officers' Reserve Corps and ordered to active duty.

(e) Civilian applicants for commissions in the S. O. R. C. for non-flying duty in capacities such as engineer, supply or other officer, may take mental and physical examinations (the latter less rigid than that for flying duty) and if qualifications are satisfactory may be commissioned and ordered to active duty.

(f) All communications in regard to officers of the Army Air Service pass through the Aero Personnel Division. Similarly, all orders for officers of the Air Service that are requested from the Adjutant General pass through this Division. Complete military records of officers are also kept there.

(g) Applications of enlisted men of the Signal Corps proper, or of other staff corps or departments, or arms, for transfer to the Air Service should be approved by the Aero Personnel Division, before orders are issued for such transfer.

(h) Any officer of the Regular Army who is an applicant for detail in the Air Service, has his military record and correspondence concerning him kept by the Aero Personnel Division while he is undergoing training at the Signal Corps flying schools. Upon detail in the Air Service the status of such an officer in relation to this Division is precisely like that of other officers of the Army Air Service.

In all cases, application for enlistment, transfer, detail or commission, is made direct to the Aero Personnel Division.

V—Schools of Military Aeronautics Division

Successful candidates for flying duty are directed by the Aero Personnel Division to one of the eight ground schools located at the following institutions:

Massachusetts Institute of Technology, Boston, Mass.
Cornell University, Ithaca, N. Y.
Ohio State University, Columbus, O.
University of Illinois, Urbana, Ill.
Texas University, Austin, Texas.
University of California, Berkeley, Cal.
Princeton University, Princeton, N. J.
Georgia Institute of Technology, Atlanta, Ga.

Upon arrival, the S. M. A. Division is advised thereof, with a list, which list is kept by the S. M. A. Division in co-operation with the Organization and Training Section. Now the students are under the charge of the S. M. A. Division.

Here the students serve eight weeks with the pay of a first class private, about a dollar a day, and with an allowance of a dollar a day for rations. Quarters are provided in barracks. Students are given intensive instruction in aeronautical engines, telegraphy, machine guns, bombing and fighting, aerial observation and co-operation with artillery and infantry including map-reading, contact patrol and reconnaissance; army regulations and military subjects; flying, with meteorology, instruments, compasses, photography and other; rigging, care and repair of aeroplanes, engines and cameras. Guns and other apparatus are provided for practical study. Upon completion of this course the students are assigned through the Aero Personnel Division to the aviation school squadrons, as noted under "Organization and Training."

VI—Construction Division

The functions of the Construction Division are: the locating of sites for flying schools and squadrons, preparing deeds or leases and entering into contracts for the preparation of the ground and the construction of buildings. This Division may consult other departments, such as the Aircraft Production Board, for instance, but the actual control of these operations is in its hands. Once the field is completed and in shape for the purpose for which it is intended, its operation is taken up by the Aeroplane Division, Organization and Training Section.

VII—Balloon Division

The Balloon Division has charge of all matters pertaining to lighter-than-air craft. Captive ballooning is being developed; first for the reason that observation balloons are urgently needed abroad. The training of pilots and observers for captive balloons involves a preliminary course in free ballooning, using the ordinary spherical type. This is necessary for the reason that when captive balloons break away from the holding cables, they must be maneuvered and landed safely in the same manner as spherical balloons.

The principal army balloon school is at Fort Omaha, Nebr., the entire post being utilized for this purpose. At St. Louis, the Missouri Aeronautical Society is also training balloon pilots as a civilian balloon school in accordance with special regulations No. 50, War Department, and it is possible that one or two additional civilian balloon schools will be utilized in the same way. It is expected that the ballooning instruction at the Fort Omaha school will progress from the captive ballooning to dirigibles as soon as practicable.

The principal function of observation balloons is, first, to keep constant watch of everything of military interest in the sector of the enemy's territory which is assigned to each balloon, and observing and reporting the fall of artillery projectiles. Reports from the balloon to the ground are by telephone connection.

VIII—Radio Division

The Radio Division deals with the organization and operation of radio work in completed aero squadrons or aviation school squadrons and practically applies the results of the work conducted by the Aircraft Engineering Division.

(*Continued on page 676*)

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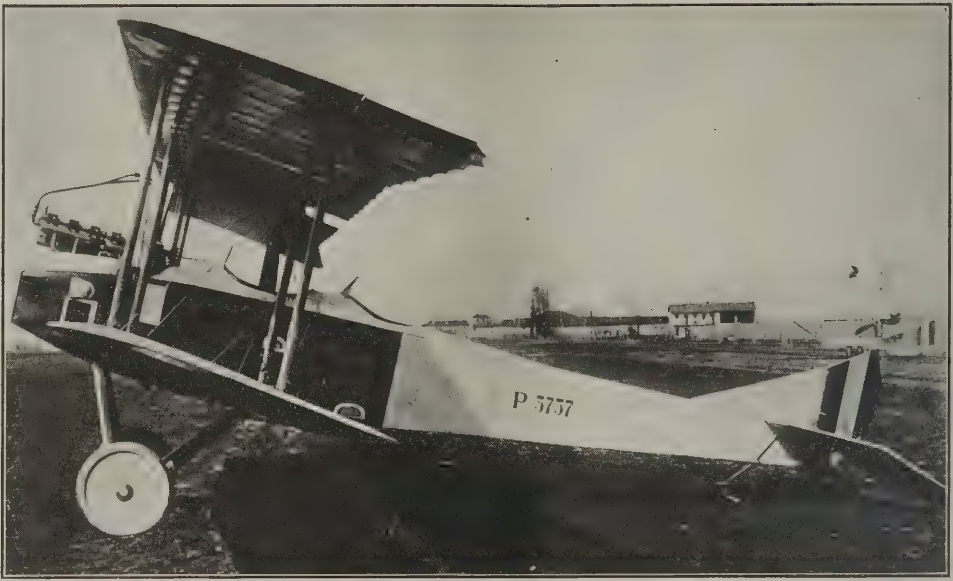
*Inasmuch as all enlistments are for the period of the war and the policy of the office is to accept men for the Regular Army only, Paragraph (b) following is modified to this extent.

The 200 H.P. Pomilio Biplane



AERONAUTIC DEVELOPMENTS IN ITALY

ITALY'S experiences in military aeronautics which she entered, practically a newcomer, in 1915, and which have enabled her now to produce the most powerful aeroplane in the world, a craft driven by motors totaling 900 horse-power, and capable of sustaining three tons besides the crafts own displacement and the weight of its operator and fuel are an indication of the possibilities which the recently energized activities of this country may accomplish. For, according to Major R. Perfetti of the Italian Royal Flying Corps, nearly all of Italy's aircraft, at the front and now under construction, have been manufactured of raw materials supplied by this country, the same type and quality of materials which are now at the disposal of the United States Aircraft Production Board, and the industry that has developed these materials into finished products of the highest type is itself the development of manufacture that in February, 1915, employed only 100 men. Now 40,000 are engaged in aeroplane manufacture in Italy.

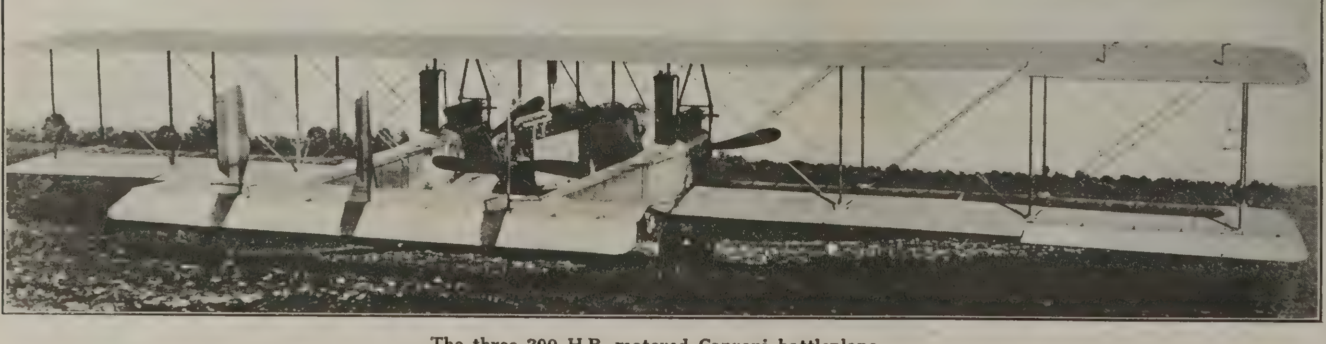
In an address delivered last week at the Automobile Club under the auspices of the Aero Club, Major Perfetti extended the thanks of Italy to the United States for the assistance of this country in advancement of Italian aeronautics, and, after an explanation of the efforts of Italian aeronauts to develop motors of especially high power, made a plea that the United States devote itself to the creation of very large engines.

"Italy has made tremendous progress in the technique of aeroplane construction," said Major Perfetti. "She has created a range of types which represent the fastest aeroplane in the world, with a speed of 139 miles an hour, the fastest seaplane, with a speed of 112 miles an hour, and the largest aeroplane, the Caproni triplane, with a 900 horsepower motor and capable of carrying three tons. But we and the United States must make still more progress.

"Since the beginning of the war in 1914 we have seen the land armies attain a sort of balance which would be difficult to upset without great sacrifice of life. But it must be upset or some other solution must be found, for the extensive success of the submarine is threatening the supply of materials essential, not only to sustain life, but to conduct the war. We must find a method which will drive the enemy back, not a mile or two, but for tens and hundreds of miles. To accomplish this the important supply bases of the enemy must be destroyed, or rendered temporarily useless, and the aeroplane seems to offer the only immediate solution.

"Until now the chief factor in military operations has been the gun designed to discharge large quantities of high explosives. The aeroplane has been used chiefly for scouting. Now the aeroplane must be used as an instrument for carrying and discharging explosives beyond the range of land batteries and the supply of explosives each plane carries must be large.

"The possibility of accomplishing this is apparent when one studies the history of the aeroplane in war. The first planes were equipped with motors of 100 horsepower and under, and they had a comparatively short cruising radius because of inability to carry both fuel and explosives; one or the other had to be sacrificed.



The three 200 H.P. motored Caproni battleplane

The 200 H.P. Macchi seaplane

"To-day we have reached a point where the 1,000 horsepower motor may be turned out capable of carrying three tons and more of useful weight and with a cruising radius of 300 to 350 miles, and it is along these lines that Italy has been conducting experiments. The big Caproni triplanes are already in use by our Government for transportation of men and supplies between military centers, and their carrying range, both in weight and distance, will be increased as development proceeds.

"Besides this, Italy has manufactured a large number of the famous semi-rigid Farlanini dirigibles, which are more efficient than the Zeppelins, half of the weight of the Zeppelin aluminum frame having been eliminated in the Italian construction. For two years the Farlanini have convoyed ships nightly from Italian ports, keeping a watch for U-boats, and not a ship so convoyed has been sunk."

"But, successful as this nation has been, Major Perfetti asserted that the combined aerial resources of the Allies were inadequate to the program which he proposed, and he urged the United States as the most valuable immediate step it could take, to begin the construction of vast numbers of aeroplanes and the development, especially of great motors.

With A. Pomilio, an electrical engineer, Major Perfetti has been in this country for two years studying American aeronautics for his Government and contracting for the supply of aeroplane spruce, motor parts and so forth, which have made the Italian construction possible.

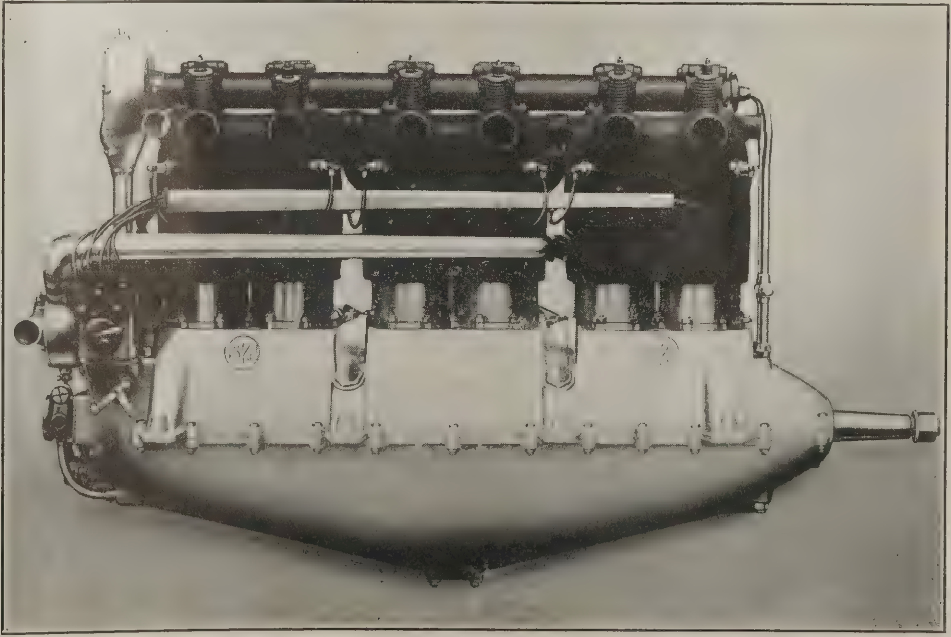
Some of the machines which Major Perfetti spoke of were astonishingly large. The 1,800 h.p. Caproni, carrying a load of five tons of explosives and fuel for twelve hours, has a speed of 80 miles per hour. The 600 h.p. Caproni triplane has two fuselages, with three Fiat or Isotta-Fraschini motors. Each of the engines is independent of the others, so that if two engines should stop the machine could still keep in the air with the power of one engine. The machine carries a useful load of 4,400 pounds, which permits carrying fuel for six hours, a crew of three people, three guns and 2,750 pounds of bombs. It has a speed of close to 80 miles an hour and is capable of climbing 3,250 feet in 13 minutes, 6,500 feet in 27 minutes and 10,000 feet in 57 minutes.

The 600 h.p. Bombing type Caproni biplane, illustrated herewith, has the remarkable speed of 92 miles per hour. It is equipped with three Fiat motors of 200 h.p. It can climb 3,250 feet in 6 minutes and 30 seconds, 6,500 feet in 14 minutes and 10,000 feet in 35 minutes.

The 200 h.p. S. I. A. armed reconnaissance biplane is a two-seated machine with a speed of 118 miles per hour and a climbing speed of 3,250 feet in 3 minutes.

Besides the above Italy has developed several other efficient types of seaplanes and fighting aeroplanes including the Macchi seaplane, with a speed of over 110 miles an hour; the Pomilio gun carrying biplane with a speed of 108 miles an hour, and the S. V. single seater fighting tractor which is reported to give a speed of close to 140 miles an hour and a climbing ability of 10,000 feet in 8 minutes.

The S. P. A. 200 H.P. aero motor



(*Continued from page 673*)

Aircraft Production Board

The functions of this board, organized by the Council of National Defense, is to consider the situation in relation to the quantity production of aircraft in the United States and to cooperate with the officers of the Army and Navy and of other departments of the Government interested in the production and delivery to these departments of the needed aircraft in accordance with the requirements of each department.

This board has no legal authority and its work is advisory only, but its recommendations are made effective through the Finance and Supply Division, which asks the approval of the Aircraft Production Board as to the qualifications of the manufacturer to whom it is tentatively about to award a contract. The programme is outlined as follows:

Engineering.—To co-operate with the Aircraft Engineering Division of the Army (and with the correlative branch of the Navy), with all manufacturers, engineers and laboratories to advance the science of aviation and aerostation and to stimulate the production of better types of aircraft.

Specifications and Standardization.—To advise and assist in such standardization of material and parts, and, as far as practicable, of types of aircraft as will aid in increasing the productive capacity of the industry in the most efficient forms of aircraft.

Production.—To investigate sources of supply of aircraft and their materials and to assist in the formulation and execution of such plans as may be necessary to enable the Government to purchase all kinds of aircraft of the types in the quantities desired. This includes—

(a) Co-ordination of designs of all aircraft matters through officers of allied countries stationed here for that purpose.

(b) Arrangements with existing American factories as to kinds of aircraft and their component parts best suited to their organization and facilities and quantities to be built by them.

(c) Suitable arrangements, when necessary, to advance Government funds where larger contracts are considered than can be privately financed, or to make arrangements on a cost-plus basis.

(d) Utilization of such idle facilities and the erection of such new sources of supply as, in the judgment of the board, are necessary to meet the needs of the Government.

Inspection.—To co-operate with the aeronautic inspection organization of the Army and the Navy and start to assist in co-ordination of their present systems of inspection to the end that, if possible, there be one system, one standard and one organization for the inspection of aircraft in this country.

Aviation Schools.—Following the selection of sites, to advise in regard to buying or leasing the land, the preparing it for use and the erecting of buildings.

Supply Depots.—Following the approval of sites, to advise in regard to the leasing of land and erecting the necessary buildings.

Priority.—To advise regarding the priority of deliveries of aircraft material as between the departments in accordance with the general policy as determined by the Council of National Defense.

Joint Army and Navy Board of Aeronautical Cognizance

This joint board was organized with representatives of the Army and Navy as members for the purpose of formulating plans and regulations for joint development and to settle broad questions arising between the two services, distinctive insignia, respective responsibilities and spheres of action, methods of cooperation, joint maneuvers and various other allied subjects.

Joint Army and Navy Board for Rigid Dirigibles

The specific purpose of this board is the design and construction of a rigid dirigible. This work is being prosecuted in the Navy Department.

Joint Army and Navy Board of Design and Specifications

This is another joint technical board, composed of Army and Navy officers and has to do with the decision as to respective types of aircraft.

Chief Signal Officer
Brigadier General George O. Squier.
Executive Officer
Colonel C. McK. Saltzman.
Aeroplane Division
Lieutenant Colonel Jno. B. Bennett, Major B. D. Foulois.
Organization and Training Section
Captain T. D. Milling
Lieut. Philip J. Roosevelt, U. S. R.
Intelligence Section
Major H. H. Arnold
Lieut. Ernest Jones, U. S. R.
Equipment Section
Captain L. H. Brereton
Capt. J. W. Gallagher, U. S. R.
Lieut. S. Katzman, U. S. R.
Aircraft Engineering Division
Major Heny Souther, U. S. R.
Captain G. R. Wadsworth, U. S. R.
Airplane Section
Captain V. E. Clark
Captain H. S. Martin
Power Plant Section
Captain Howard Marmon, U. S. R.
Inspection Section
Capt. H. W. Harms (field)
T. W. Mixter (raw material)
B. D. Gray (finished material)
Transport Section
A. J. Slade
Design and Experimention Section
Capt. H. S. Martin (Aeroplanes)
Capt. V. E. Clark (Aeroplanes)
Capt. Howard Marmon (Engines)
Capt. C. C. Culver (Radio
Capt. R. H. Willis, Jr. (Ordinance)
Capt. C. C. Culver (Photography)
Capt. H. S. Martin (Instrument & Accessories)

Finance and Supply Division
Capt. A. G. Gutensohn
Capt. R. M. Jones
Lieut. Col. C. S. Wallace
Captain George H. Brett
Capt. L. R. Evans
Capt. H. D. Moore

Aero Personnel Division
Captain Aubrey Lippincott
Capt. W. A. Larned, U. S. R.
Captain R. B. Owens, U. S. R.
Capt. Thomas H. McConnell, U. S. R.
Lieut. Arthur Hadley, Jr., U. S. R.
Schools of Military Aeronautics Division
J. C. Farrar
Major Hiram Bingham, U. S. R.
Russell MacDonald
Capt. Frank C. Page, U. S. R.

Construction Division
Captain C. G. Edgar, U. S. R.
Capt. C. S. Benton, U. S. R. (Transportation)
Capt. K. C. Grant, U. S. R. (Engineering)
Capt. H. Bennington, U. S. R. (Auditing-Accounting).

Balloon Division
Lieut. Col. Charles DeF. Chandler
Capt. J. C. McCoy, U. S. R.
Lieut. B. D. Daggett, U. S. R.
Lieut. Paul Pleiss, U. S. R.

Radio Division
Major N. H. Slaughter, U. S. R.
Capt. C. C. Culver

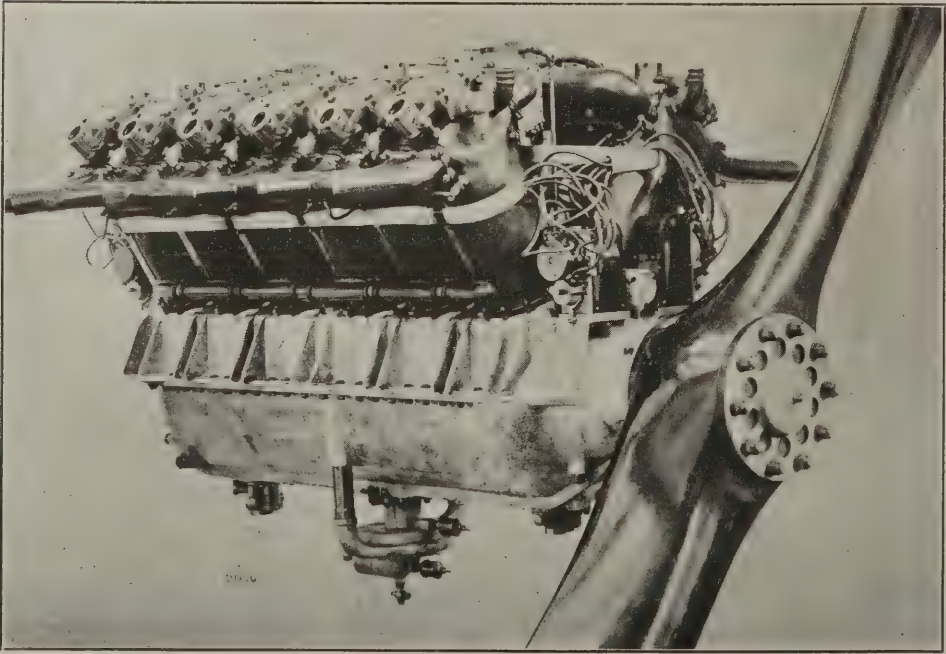
Aircraft Production Board
Howard E. Coffin, Chairman
Brig.-Gen. G. O. Squier
Rear-Admiral David W. Taylor
Arthur G. Cable, Sec.

Sidney D. Waldon
E. A. Deeds
R. L. Montgomery

Joint Army and Navy Board of Aero Cognizance
Brig.-Gen. G. O. Squier, U. S. A.
Capt. J. S. McKean, U. S. N.
Major S. M. Embick, U. S. A.
Capt. V. O. Chase, U. S. N.
Capt. G. S. Marvell, U. S. N.
Major D. T. Moore, U. S. A.

Joint Army and Navy Board for Rigid Dirigibles
Rear-Admiral David W. Taylor, U. S. N.
Lieut.-Col. Chas. DeF. Chandler, U. S. A.
Capt. V. E. Clark, U. S. A.
Brig.-Gen. G. O. Squier, U. S. A.
Lieut. J. H. Towers, U. S. N.
Lieut. W. G. Child, U. S. N.
Asst. Naval Constructor, James C. Hunsaker

Joint Army and Navy Board of Design and Specifications
Lieut. A. K. Atkins, U. S. N.
Lieut. J. H. Towers, U. S. N.
Asst. Nav. Const. J. C. Hunsacker, U. S. N.
Major B. D. Foulis, U. S. A.
Major Henry Souther, U. S. R.
Capt. H. W. Harms, U. S. A.



The 12 cylinder, 600 h.p., Fiat aero motor. Length, 6′ 15/16″; width, 3′ 15/16″; height, 4′ 3/16″.

MILITARY AEROSTATICS

$27,710,550 FOR AEROSTATICS

The $640,000,000 appropriation which was passed by the House of Representatives on July 14 and by the Senate on July 21 makes available $27,710,550 for aerostatics.

Therefore the Balloon Division will be twice as extensive as the entire aeronautic branch of the Army was last year, when Congress made available for the entire Air Service of the U. S. Army the sum of $13,981,000.

The Balloon Division is in charge of the pioneer expert in that branch, Lt. Col. Charles de F. Chandler, who is ably assisted by Major Lahm, Major Hersey, Captain McCoy and A. Leo Stevens.

It is hardly necessary to point out that these five gentlemen are pioneers in aerostatics in America and they are most energetic men; therefore, quick, substantial developments can be expected, although on account of our inactivity in military aerostatics heretofore these gentlemen and the experts cooperating with them have to build an organization from the ground up.

Rules and Regulations of the International Aeronautic Federation Governing the Issue of Pilot's Certificates.

The Aero Club of America may grant aeronautical and aviation pilots' certificates to persons who are over eighteen (18) years of age, citizens of the United States, or citizens of a country not represented in the F. A. I., or citizens of a country represented in the F. A. I., with the permission of the representative organization of the applicant's nationality.

The following are the rules under which certificates are granted by the Aero Club of America:

1. A person desiring a pilot certificate must apply in writing to the Secretary of the Aero Club of America. He must state in his letter the date and place of his birth, and enclose therein two unmounted photographs of himself about 2¼ x 2½ inches, together with a fee of five dollars. In case the applicant is a naturalized citizen of the United States he must submit proof of naturalization.

2. On the receipt of an application the Secretary will forward it promptly to the Contest Committee, which, in case of an application for an aviator's certificate, will designate a representative to supervise the test prescribed by the International Aeronautical Federation and will advise the representative of the name and location of the applicant and, through the Secretary, advise the applicant of the appointment of the representative to take the test.

3. In case the application is for a spherical balloon or for a dirigible balloon pilot certificate the applicant will be fully advised by the Contest Committee.

4. All applications for aviator's certificates must reach the Secretary a reasonable time in advance of the date that the applicant may expect to take the required test.

5. No telegraphic applications for certificates will be considered.

Applicants for each class of certificate must be of the age of 18 years, and in the case of dirigible certificates 21 years, and must pass, to the satisfaction of the properly designated representatives of the Aero Club the tests prescribed by the F. A. I. as follows:

The observer in a kite balloon directing artillery fire.

Spherical Balloon Pilot's Certificate

Candidates must pass the following tests:

(A) Five ascensions without any conditions.

(B) An ascension of one hour's minimum duration undertaken by the candidate alone.

(C) A night ascension of two hours' minimum duration comprised between the setting and the rising of the sun.

The issue of a certificate is always optional.

Dirigible Balloon Pilot's Certificate

Candidates must be 21 years of age.

They must hold a spherical balloon pilot's certificate and furnish proof of having made twenty (20) flights in a dirigible balloon at different dates.

They must also undergo a technical examination.

In case, however, the candidate does not already possess a spherical balloon certificate, he must have made twenty-five (25) ascensions in dirigibles before he can apply for a certificate.

The application for the certificate must be countersigned by two dirigible balloon pilots, who have been present at at least three of the departures and landings of the candidate.

The issue of the certificate is always optional.

Italian Dirigibles Have Protected Italian Steamers for Two Years

The importance of dirigibles for convoying ships is emphasized by the fact that for two years the Italian "Forlanini" dirigibles have been used to convoy steamers between Italian and French ports. The steamers usually travel at night and early morning and the dirigibles convoy them and guard them against submarine attacks.

The Forlanini dirigibles are of the semi-rigid type, which affords all the efficiency of the rigid type, minus half of the weight of the frame of the rigid type, so that the semi-rigid dirigible can carry much more useful weight than the rigid dirigible.

THE ALBATROS D. 1. "CHASER" BIPLANE

ONE of the most formidable of the various types of German machines has been the Albatros "Bu" chaser scout. The "D. 1" bears signs of previous Albatros practice in several instances, mostly in a modified form, but there are also some radical innovations. Perhaps the most noticeable features consist of the monocoque *fuselage*—which is built up entirely of wood without any wire bracing—and the arrangement of the planes.

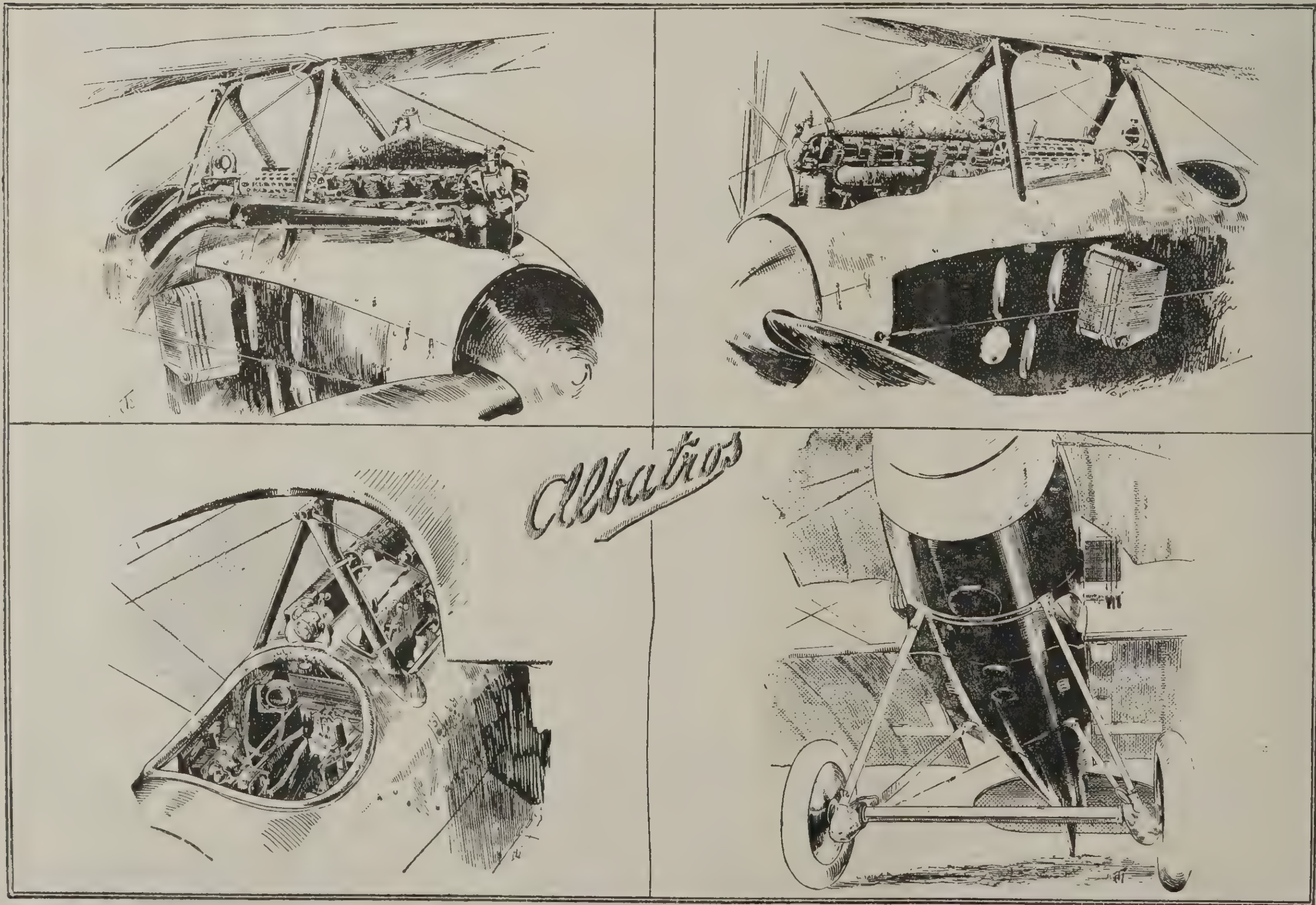
The latter, contrary to German practice, have neither sweep-back nor dihedral—the top plane, in fact, being one complete unit. The wing curve is similar to the Albatros "C. III," but having a flatter camber, whilst the angle of incidence varies from 5° 3′ at the centre to 4° and 2° at the left and right hand wing-tips respectively. A somewhat novel feature consists of the method of adjusting the stagger of the top plane from 0 to 12 cm., by moving it along the top of the *cabane*. This is effected in the following manner: In each end of the top horizontal tube of the *cabane* is formed a slot, which receives an eyebolt passing through the main spar of the plane. At each slot are five holes passing horizontally through the tube, one of which—according to the adjustment required—receives the bolt that locks the eyebolt in the *cabane*. The arrangement is shown in one of the accompanying sketches which we are enabled to present through the courtesy of our English contemporary *Flight*.

In order that the correct gap should be maintained in each adjustment for stagger, the lower end of the interplane struts and the *cabane* struts can be adjusted accordingly at their attachments to the planes and *fuselage* respectively. As may be seen in two of the accompanying sketches, this is done by means of the screw adjustment on the ends of the struts as shown. Only one pair of struts on each side of the *fuselage* separate top and bottom planes, these struts being of streamline steel tube. The attachment fittings are shown in the sketches, from which it will be seen that the top fittings are slightly different from the lower ones, which, as previously stated, are adjustable. As in other Albatros machines the main spars are located well forward, the front one being some 4 inches from the leading edge, and spaced 2 feet 7½ inches from the rear one. They are of the usual Albatros rectangular section, fabric bound, and are bevelled off on the top at the extremities. The ribs, which are spaced 16¼ inches apart in the top plane and 13¾ inches in the bottom plane—except where the interplane struts are attached where the rib is displayed by a tubular compression member—are built up of slotted-out webs and somewhat narrow flanges. Between the leading edge and the front spar the upper surface of the plane is stiffened by a false rib between each of the ribs proper.

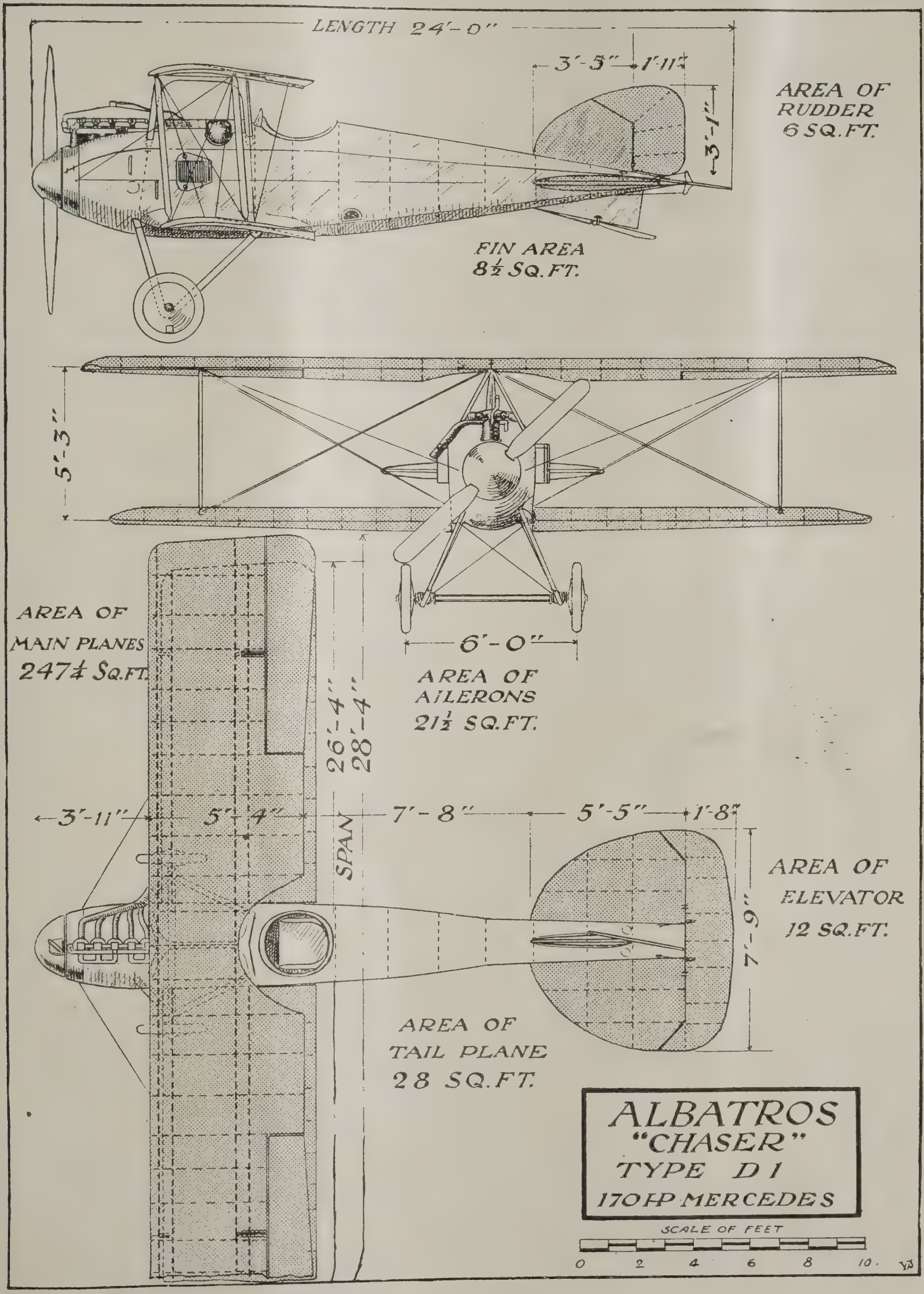
The lower plane is attached to an abutment built out from, and flush with the side of the *fuselage*. The mounting, which is shown in one of our sketches, consists of a form of bayonet socket-joint, access to which is obtained by means of doors on the under sides of the plane. As on other Albatros machines, the *ailerons* are given a wash out at the tips, and have operating cranks working in slots in the plane. They are hinged on auxiliary spars on the top plane only. The span of the top plane is 28 feet, 4 inches and that of the lower 26 feet, 9 inches, the chord of both being 5 feet, 9 inches, and the gap 5 feet, 3 inches. The total supporting surface is 269 square feet.

The stabilizing plane, semi-elliptical in plan form, is divided into two parts, and is exceptionally thick (5¾ inches). It is non-lifting, and is mounted, in the line of flight, without any external bracing. The framework is wood and the covering fabric. Hinged to the trailing edge of the stabilizing plane is single elevator balanced by small triangular extensions forward of the outer extremities. A rounded vertical fin, like the stabilizing plane very thick, is mounted on the top of the **fuselage** some distance forward of the extremity of the latter. It has a wood framework and a covering of three-ply. To its trailing edge is hinged the rudder, which is balanced by a triangular portion extending forward, and at the top of, the rudder post. The rear edge of the rudder does not extend further than the extremity of the *fuselage*. A small triangular fin, also of three-ply, is formed under the *fuselage* by the supports for the tail skid. The framework of the elevator and rudder is of steel tubing, covered with fabric. The rudder control cables are inside the *fuselage;* two small doors on the top of the latter allow for inspection and adjustment. The elevator cables also pass inside the *fuselage*. The junctions of the fins and stabilizing planes with the *fuselage* are rounded off with three-ply.

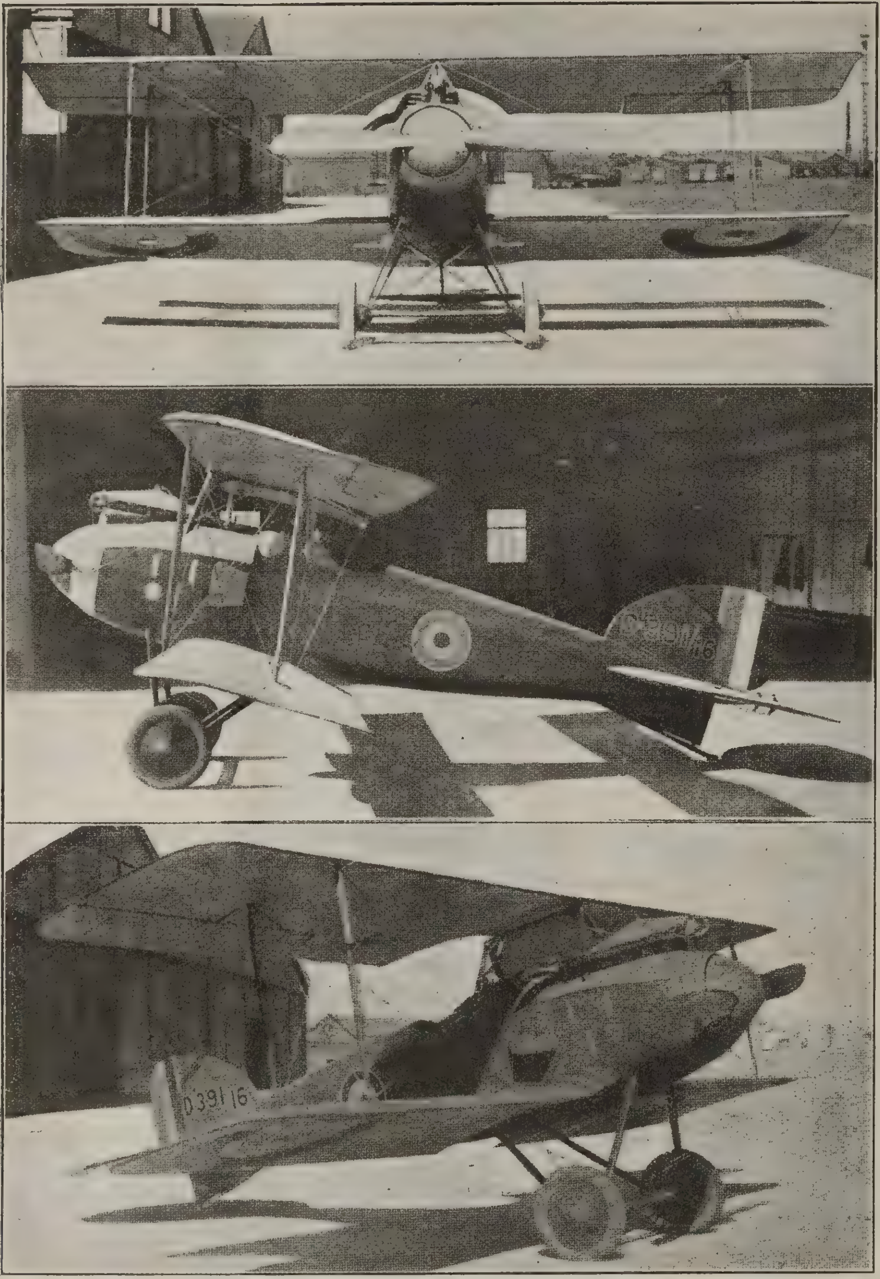
In the *fuselage* are to be found many points of interest. It is a modification of the standard Albatross system of *fuselage* construction, but differs in that it approaches nearer the true *monocoque*. It is, in fact, a compromise



THE ALBATROS D.1.—Top: On the right a view of the exhaust side of the 170 h.p. Mercedes engine, and on the left the inlet side. Both views show the location of the machine guns. The right-hand lower sketch gives a view of the cockpit, and on the left a view below the nose of the *fuselage*, showing the mounting of the chassis and the abutments for the wing attachment.



ALBATROS
"CHASER"
TYPE D I
170 HP MERCEDES



Three views of the Albatros Chaser Biplane

between the two, and suggests itself as an excellent solution to the problem of the "commercial" *monocoque*—simple in construction, low in cost, and of great strength. In section it varies from circular at the nose, to a horizontal knife-edge at the rear—being flat-sided, with rounded top and bottom in the centre. It is built up of six *longerons*, three a side, the central ones being of small rectangular section spruce ($\frac{3}{4} \times \frac{5}{16}$ inches in aft of cockpit, forward of which they are $\frac{3}{4} \times \frac{3}{4}$ inch L-section). The top and middle *longerons* are placed one above the other, but the bottom ones are closer together. Top and bottom members are, except at certain points, of L-section, and up to the cockpit are of spruce, forward of which ash, $1\frac{3}{16} \times 1\frac{9}{16}$ inches is employed.

The *longerons* are supported in simple transverse "formers" or ribs, reinforced at the junctions with the *longerons*, spaced at intervals of, roughly, 2 feet. These formers are ⅜ inch thick and ¾ inch deep. At the tail there are two thicket formers of the shape shown in one of the sketches. Forward of the cockpit there are four transverse formers, or supports, of three-ply, carrying the engine bearers, similar to those employed on other Albatros machines. Over the whole of this framework is laid a covering of three-play, which is tacked and screwed to the *longerons* and formers. There is no wire bracing, nor are there any struts, except for two forming continuous of the *cabane* struts extending to the chassis strut attachment. The pilot's seat is supported by two transverse tubes adjustably mounted on two auxiliary *longerons* on the side of the *fuselage*.

The engine, a 170 h.p. Mercedes, No. 27,911, does not call for any special reference, being mounted in a similar fashion to those on previous models. The radiators, however, differ from those usually employed. They are of the honeycomb type, and are mounted one on each side of the *fuselage*. Above, and to the left side of the camshaft, is a flat water tank, one end connected to the engine jacket, and the other end to the tops of the radiators. The lower orifices of the radiators are connected to the water pump at the rear of the engine. On each side of the engine is mounted a machine gun, synchronized for firing through the propeller. They are centred about 1 foot, and are operated by two triggers mounted on the grip of the control lever. One of our sketches shows the ammunition-feed arrangement for the two guns.

The control lever is of the Fokker type, operating the *ailerons* and the elevator. It consists of a $1\frac{3}{16}$ inch tube mounted on a $1\frac{9}{16}$ inch transverse tube supported on a wooden base. A locking device is fitted whereby the lever may be locked against a fore-and-aft movement enabling the pilot to remove his hands, but operate the *ailerons* with his knees. This locking device, which consists of an arrangement of rods forming an articulated parallelogram, is shown in our sketch, from which other details of the control may be seen.

The landing chassis is of the conventional V-type with rubber sprung axle carrying a pair of 760 × 100 disc wheels. Behind the axle is a transverse tubular tie rod, and the two rear struts are cable braced. The chassis is easily dismantled by withdrawing the struts from the sockets mounted on the *fuselage*.

Ground Schools Ready to Turn Out 150 Candidates a Week for the Army Fields

Washington, July 15.—There are now more 1,200 candidates for the Aviation Corps in training at the University of Illinois, the University of Texas, the Massachusetts Institute of Technology, the University of California, and the University of Ohio. A hundred are being trained at the ground schools which were opened at Princeton and the Georgia Institute of Technology on July 2. The six ground schools first named are expected to graduate an average of 150 a week every week from now on and, beginning five weeks hence, when Princeton and the Georgia Institute also begin to turn out graduates, the total for the country will be swelled to 200 a week, or a prospective 10,400 during the next year.

The ground schools turned out 142 graduates yesterday and they are to be sent at once to the army flying schools. The graduates today are:

University of Illinois—Private Maturin Ballou, Private Joseph H. Carr, R. W. Durant, Sergeant Frank Gillet, Samuel P. Halley, Private Asher Kelly, Sergeant John A. King, Robert C. Lindsay, David A. Macdonald, Charles P. McCormick, Private Neil D. McDuffie, Charles I. Merrick, R. G. Marsh, A. R. Metzger, Private James N. Nolan, Private Tom C. Perkins, Private L. G. Pugh, William C. E. Tytus, Charles H. Wacker, Jr.; R. V. Waller, Sergeant Daniel Waters, Private Ross Witherbee, Sergeant H. Wilder, Private Earl Woodward, D. J. Payne.

University of Texas—M. C. Giesecke, J. H. McClendon, R. B. Dawkins, M. M. Daugherty, I. W. Fish, J. P. Richter, J. P. Richards, E. G. Tobin, Joe G. Trees, C. S. Ferson, M. H. Rice, C. B. Maxwell, C. Thurlow, J. R. Graham, W. A. Hooveler, W. G. Morrison, B. O. Power, Alex Mathews, O. J. Gude, Jr.

Cornell University—Theodore Arter, Edwin V. Dougherty, Jr.; Thomas H. Farnsworth, Henry C. Ferguson, Paul E. Green, Paul L. Gross, Laurence Hills, Eric L. Hodge, Roger Jannus, Loyal Y. Osterlund, Reginald H. Parsons, Glenn P. Rodgers, Leslie J. Rummell, Herbert A. Schaffner, John D. Sullivan, J. W. Thompson, Charles F. Turner, Harry E. Walberg, W. Kemble Yarrow, H. H. Garside, M. E. Green, H. D. Hale, I. K. Fearn, J. A. Meissner, Harold Reynolds, L. J. Hagadorn, W. V. A. Kemp, H. W. Stunkard.

Massachusetts Institute of Technology—F. K. Baker, D. R. Buchanan, S. E. Elliott, J. G. Estill, Jr.; R. Kennedy, E. B. C. Markel, J. F. Merrick, E. E. Bates, H. H. Coolidge, W. S. Ely, C. H. Kissel, R. L. Moore, J. W. Osgood, F. S. Patterson, M. H. Powel, J. S. Roberts, W. S. Savale, W. S. Stearns, W. S. Bacon, D. Campbell, W. M. Ellis, W. H. Heinrichs, J. L. Mitchell.

University of California—L. B. Cook, J. F. O. Daube, Lyman Ellis, R. J. Gill, H. A. Ilse, D. Johnston, H. S. Kenyon, W. S. Wilson, H. R. Harris, K. Belle, W. M. Kauch, E. A. Parrott, H. H. Pope, J. F. Roullot, H. G. Schultz, S. H. Smith, E. S. Wallace, J. S. Weeks, William B. Wright, C. N. Smith, C. G. Earle, Jr.; G. H. Gale, R. P. Macdonald, William F. Wichart.

Ohio State University—W. Barron, W. T. Campbell, L. O. Eckford, C. H. Gravatt, T. J. Hillard, H. H. Leep, H. B. Vanderhoef, F. W. Eaton, F. C. Montgomery, P. Robertson, W. V. Casgrain, D. H. Young, R. E. Indick, K. L. Moore, J. B. Parker, H. H. Smelley, H. Stephenson, St. C. Streeth, L. L. Bredin, W. W. Chalmers, J. Knowles, Jr.; P. T. Pilling, and J. W. Watts.

In the plan of organization for these schools the Government supplies all the information used in the teaching courses and lectures. This is based on confidential information the War Department has been compiling for the last two and a half years, on the basis of reports from its military observers in Europe. The universities supply merely the forces, who utilize this information in the teaching, the buildings in which the candidates are housed or taught. Each school is an army post under command of an army officer, who is a West Point graduate, and a junior military aviation flyer. There is a curriculum board at each school. The army officers in command of these ground schools of military aviation are Captain Howard S. Davidson at Cornell, Captain Benjamin W. Mills at the Massachusetts Institute of Technology, Captain Ralph Cousins of the University of Texas, Captain Arnold M. Krogstad at the University of California, Captain George E. Stratmeyer at Ohio State University, Captain George W. Knapp at the University of Illinois, First Lieutenant Adlai N. Gilkerson at Princeton, and First Lieutenant H. O. Richards at the Georgia School of Technology at Atlanta.

The course lasts eight weeks.

HOW TO TEST LUMBER FOR DRYNESS

By THOMAS D. PERRY

General Manager Grand Rapids Vapor Dry Kiln

THE old terms, "bone dry," "six months' air dried," "one year on sticks," etc., are rapidly becoming obsolete and are yielding to the more scientific terms describing the relation by weight of the fiber and moisture contained in any piece of lumber.

Absolute dryness of lumber for manufacturing purposes is not practicable nor desirable. All lumber is more or less absorbent, or hygroscopic, as the scientists say, depending on whether it is hard or soft wood, dense or open grain. An easy proof of this is to try to write with ink on any piece of wood, the ink spreads and soaks in as it does on blotting paper. Theoretically it is possible to make lumber perfectly dry, but by laboratory methods only, and it must be kept hermetically sealed to retain its condition of perfect dryness. In any ordinary condition of atmosphere absolutely dry lumber will rapidly absorb considerable moisture. Commercially speaking, in work rooms of a suitable temperature and humidity for employes, lumber will not stay within 5 per cent of perfect dryness.

Perfect dryness (often called "bone dry") is a condition in which all moisture has been evaporated, leaving only dry fiber and a minute amount of granular residue from sap (nearly negligible and disregarded hereafter). Lumber with a *moisture content* (indicated by m. c.) of 5 per cent means that in addition to the dry fiber weight the board contains 5 per cent of water (by weight) or a total of 105 per cent weight compared with 100 per cent dry fiber. In other words, one-twentieth of the dry fiber weight represents the additional weight of water.

Various degrees of dryness are needed for different purposes, some produced by air dryness, and some by kiln drying, i. e.:

Glued work in funiture..........	5%
Hardwood flooring	6%
Interior trim	7%
Outside trim	10%
Shipping dry (so called)..........	12-15%

In as particular work as piano actions and keys, some parts should be 5 per cent and others, more liable to split, should not be less than 7 per cent.

The correct process (called "A") of ascertaining the moisture content of any board is given and illustrated in the following extract from the kiln operating instructions (applied to a metric scale) of the Grand Rapids Vapor Kiln:

To Test Lumber for Shrinkage and Moisture Content—Take a board from the wettest or greenest lumber that is piled on kiln car ready for entering kiln. From the center of this board cut off a piece 24 inches to 40 inches long and dress both edges. This is to serve as a stock test board, and is to go through the drying process bearing the car or load number and the date of commencement of drying operations. From this stock test board test pieces must be taken at intervals in the manner described below.

Keep this stock test board drying on the kiln car and in such a place as can be removed through instrument openings in side wall, door or end of kiln.

Before placing stock test board on kiln car:

a. Cut off about 2 inches of one end, which always reject and take another cut ¼ inch long (way of grain) to be used as a special test piece to ascertain condition of lumber before kiln drying.

b. Take this ¼-inch special test piece and with a lead pencil make a central line across it from edge to edge. Follow promptly with measurement and weight.

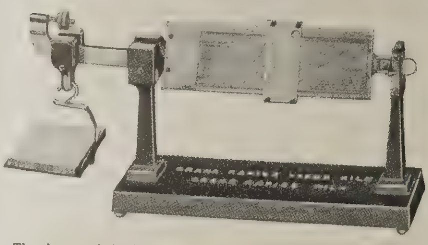
c. Measure the test piece along this line with a hook decimal rule (Section 18) and mark exact width of board above the pencil line on the left-hand side of special test piece.

d. Weigh the special test piece on metric scale and mark exact weight above the line on right-hand corner. On back side mark car number, kiln number, and date. The test piece will then appear as follows:

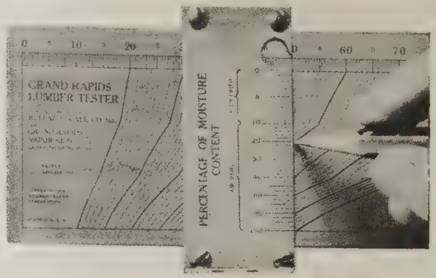
e. The special test piece must now be dried until it is bone dry, which condition is reached when it will no longer shrink or decrease in weight. If placed on a hot plate—preferably the engine cylinder—it will generally dry to the required condition in about two hours' time. Be careful not to char or burn it.

f. When it is bone dry, promptly measure the length again on the line, and mark same under the line on the left-hand side. Immediately weigh on metric scale and mark exact weight under the line on right-hand side. The test piece will now appear as follows:

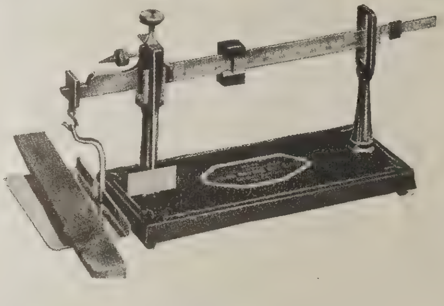
g. You will note that there has been a shrinkage in width of board, and a reduction of weight. The latter is due to evaporation of moisture. The percentage of shrinkage and evaporation must now be computed (and recorded) as follows:



The above scale is absolutely the last word in efficient testing of lumber for moisture content or dryness



Enlarged view of beam



```
Shrinkage
Before drying 8.18
Bone dry      7.86
          ------
   7.86) .3200( .04
         .3144
         -----
           .56
   = 4%
Expansion over bone
  dry.
```

```
Weight
Before dry-
  ing          45.51 grams
Bone dry       39.23
               -----
       39.23) 6.2800(  .16
              3.923
              ------
              2.3570
              2.3538
              ------
                  .32
       = 16%
Moisture content over
  bone dry.
```

Mark these percentages on your special test pieces and also on kiln record.

The above moisture content and shrinkage is a fair average of six months air dried 4/4-inch oak, before same has been put in the kiln. According to the schedule below it will take eight days to kiln dry it to 5 per cent moisture content.

Another method of computing moisture content (called "B") is used by some, although it is not considered best practice. Taking the same weights as above, it works out as follows:

```
        45.51 initial weight
        39.23 bone dry weight
        -----
 45.51) 6.28000 (13.8
        4551
        -----
        17290
        13653
        -----
        36370
        36408
```

Moisture content 13.8%.

The difference between the two methods in the above instance is 2.2 per cent. The reason for rejecting method "B" is because it is an attempt to compare the moisture removed with the initial weight, which is part fiber and part water. The comparison is neither logical nor useful, nor a true expression of moisture content. To be correct, as in "A," the comparison should be the element *water* against the single element *dry fiber*. The divisor should be all *water* and the dividend *dry fiber only*, in which case the comparison will represent the true relation between water and fiber. As the lumber tested approaches a low moisture content, methods "A" and "B" approach each other, i. e.:

```
         "A"                          "B"
        62.65                        62.65
        59.62                        59.62
        -----                        -----
59.62) 3.030000 (5.08        62.65) 3.030000 (4.83
       2.9810                       2.5060
       ------                       ------
        49000                        52400
        47696                        50120
        -----                        -----
         1304                        22800
                                     18795
                                     -----
                                      4005
```

Method "B" shows more serious inaccuracies when applied to green lumber, i. e.:

```
         "A"                          "B"
        85.32                        85.32
        60.00                        60.00
        -----                        -----
60.00) 25.32000 (42.20       85.32) 25.320000( 29.67
       24.000                       17.064
       ------                       ------
        1.3200                       8.2560
        1.2000                       7.6788
        ------                       ------
         12000                        57720
         12000                        51190
                                      -----
                                      65280
                                      59724
```

Summarizing, we find the comparison as follows:

	"A"	"B"	Differerence
Moderately green (40%)..	42.20%	29.67%	12.53%
Well air dried (15%)...	16.00%	13.80%	2.2%
Kiln dried (5%)..........	5.08%	4.83%	.25%

There seem to be no valid reasons for adopting method "B", as the differences are dangerous. The Forest Products Laboratory, maintained by the United States government at Madison, Wis., has adopted "A" for use in all experiments and publications.

In the above extract from the operating instructions of the Grand Rapids Vapor Kiln is included a method for determining the shrinkage in lumber. This is particularly useful in testing kiln dried lumber which is to be used in glued work. Shrinkage varies according to the cut of the board, the method and rapidity of air drying, the rankness of the growth rings, etc. Lumber with a shrinkage in excess of 1 per cent is liable to cause trouble in glue joints. Sometimes kiln dried lumber will test 5 per cent moisture content, and still have 1½ to 2 per cent shrinkage. Such lumber should be continued in the kiln until shrinkage is 1 per cent or less.

There are three main reasons for testing the moisture content of lumber, as follows:

I. When you empty your kiln, to insure properly dried lumber.

II. When you put lumber in your kiln, to see how long it should dry.

III. When you buy your lumber, to be sure you are receiving what you bargained for.

A proper schedule to apply to your kiln under section II can be worked out by your kiln operator, providing the same is not supplied by the kiln designer. As an example the following schedule is furnished by the Grand Rapids Vapor Kiln and is a conservative statement of the time necessary to dry lumber to 5 per cent moisture content in that particular type of drying apparatus. Many of those using this type of kiln dry in quicker time, dependent on the skill of the operator.

Wood	Moisture Content	4/4" Thick Days	6/4" Thick Days	8/4" Thick Days
Hardwood......	15%	7	10	14
	16-20%	8	12	16
	21-30%	10	15	20
	31-40%	15	20	28
	41-50%	20	28	35
Semi hardwood	25%	4	6	8
	26-50%	5	7	10
	51-75%	6	9	12
	76-100%	7	10	14
Soft wood....	25-50%	3	4	6
	75-100%	4	6	8

The above tabulation is based on the continuous use of steam during 24 hours per day. With steam during the ordinary working hours (except severe weather), the time of drying will be increased one-half.

For convenience in figuring the per cent of moisture content, scales should be graduated on the decimal system, metric scales answering this requirement admirably. Detached or separate weights are easily lost, therefore permanently attached "poises" (or sliding weights) are better. The illustration shows a type of scale especially designed for weighing lumber.

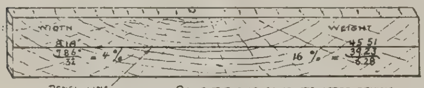
This scale, however, requires computation on the part of the user, and is therefore subject to human error, and in lumber kiln work, sometimes the error of an uneducated or ignorant kiln operator is appalling.

To avoid this human error, and we are all subject to it, the computing scale has been devised, where the moisture content readings (computed and charted on correct method "A") are taken directly from the sliding poise on the scale beam.

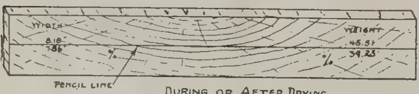
This computing scale may be used by exactly the same method as first scale shown, but for all practical purposes (within a limit of ½ per cent accuracy) can be used by observing the nearest gram and reading off the nearest per cent. An enlarged view of the beam proper and the manufacturers' instruction for use follow:

Approximate Method (Kiln Dried Stock)

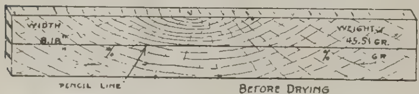
Cut one or more samples, each ¼ inch (or less) in thickness long way of grain so that total weight will be between 50 and 100 grams. Brush off splinters and loose pieces. Weigh immediately to nearest gram and mark total weight. Reduce all pieces of sample to bone dry by leaving on engine cylinder, in oven or on electric heater, for two or three hours, or until a constant or minimum weight is reached. Re-weigh the identical samples immediately after removing from heat and leave poise at exact weight to fraction of gram. Place pencil or other pointer on chart line at initial weight and follow down and left to final weight where poise stands. The point where chart line meets percentage scale on poise will give moisture content percentage reading on poise. The chart is drawn so that moisture content percentage is computed on basis of bone dry weight.



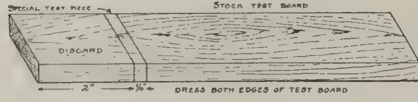
COMPUTATIONS COMPLETE AFTER DRYING



DURING OR AFTER DRYING



BEFORE DRYING



Exact Method (Kiln Dried Stock)

Proceed as above except that the initial weight must be brought to an exact gram by whittling or filing away a trifle from one of the samples. This may require several trials and such accuracy is seldom required.

Air Dried and Green Lumber

The percentage scale on poise has finer divisions for percentages under 10 per cent, since closer results are required in testing kiln dried stock within this range. Above 10 per cent the divisions are for air dried and green stock. Testing samples with an aggregate weight of less than 50 grams is not advised.

Computing Method

This scale may be used on the usual computation, where desired, estimating tenths of a gram. The percentage is figured as follows:

67.5 initial weight 63.2) 4.300(6.8 per cent
63.2 final weight, bone dry 3.792 moisture content
——
5080
4.3 moisture removed 5056
——
24

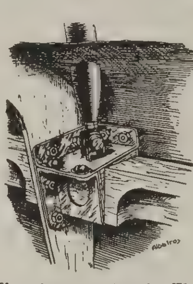
This is independent of chart and may be used for checking if desired.

The great advantage of the computing scale is its freedom from error in subtraction and division. In other words, it is "fool proof." The simplicity of its operation encourages frequent testing, and frequent testing means uniformly dried lumber. Anyone can use the scale, and it can be used for many other materials than lumber, such as testing for moisture content in paper, coal, glue, etc. Lumber at best is a variable material, due to processes of growth, and every provision should be given workmen to encourage them in keeping lumber dryness uniform in the woodworking shop.

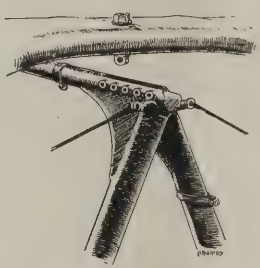
The time is not far distant when purchases of lumber will be made on a moisture content basis, as indicated in section III. Terms like "well air dried," "six months on sticks," etc., have caused much needless profanity on the part of lumber users. The terms are not descriptive, and have been, at best, woefully abused by sellers of lumber. Lumber is valuable, according to the speed with which it can be converted into finished product.

Green or partly air dried lumber, that requires excessive kilning, or even yarding preliminary to kilning, is worth less than well air-dried lumber ready for use after a minimum time allowance for kilning. The modern vapor method of kiln drying enables the purchaser to dry even green lumber in shorter time and better condition than 12 months' air dried stock can be dried in older type of drying installations. It is perfectly apparent that even the vapor method will be more speedy on well air dried stock than on green material. With a vapor kiln in operation, the yard stock can be diminished, or eliminated altogether.

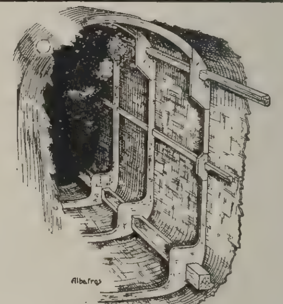
A price penalty for high moisture content in lumber bought and a bonus for low moisture content would be beneficial to buyer and seller alike. Proper instruments, efficiently used, will make this possible.



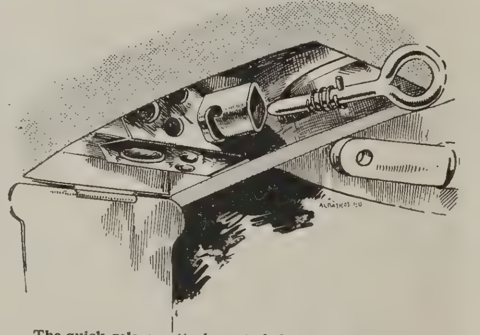
The Albatros D. 1.—The attachment of the *cabane* to the *fuselage*, showing the screw adjustment for alteration of stagger.



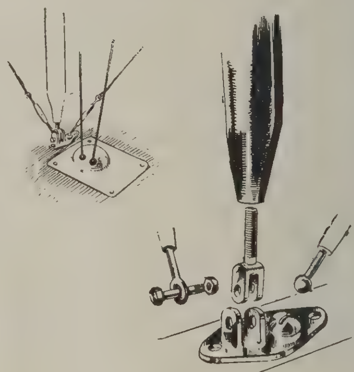
The adjustment of the top plane on the *cabane*.



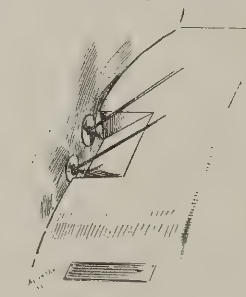
The *fuselage* construction.



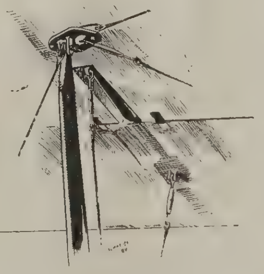
The quick release attachment of the lower plane to the *fuselage* on the Albatros D. 1.



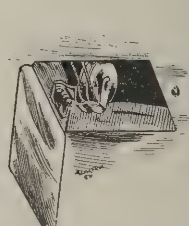
The adjustable interplane strut attachment.



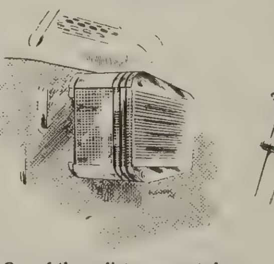
The anchorage of the lift cables on the Albatros D. 1.



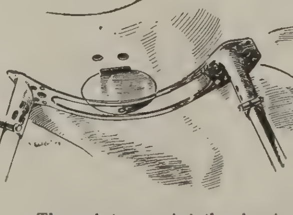
The interplane strut attachment to the top plane, and the *aileron* crank lever.



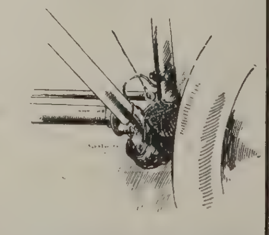
The *aileron* pulley inspection door on the lower plane.



One of the radiators mounted on the side of the Albatros D. 1.



The sockets securing the chassis struts to the *fuselage*. The struts may quickly be detached by loosening the bolts on the sockets.



The shock absorber on the landing chassis. It will be seen that the rubber strands are interlaced.

Details of Albatros construction illustrating article printed on page 680 of this issue

FOREIGN NEWS

COSTA RICA

San Jose, Costa Rica, July 22.—A mysterious aeroplane, painted yellow and black, has been flying over Costa Rica recently.

American residents express the belief that it is a German machine, and have advised the Panama Canal forces of its presence.

FRANCE

French Front in France, July 21.—The Lafayette Flying Squadron made fourteen patrol flights along the enemy's lines during the week ended July 14. Sixty-seven aeroplanes took part in these flights. The airmen fought fifteen air battles, of which Corporal Willis was a participant in five, Lieut. de Maison Rouge in four, Adj. Lufberry and Edwin Parsons in two each and Lieut. Thaw and Sergeant Haviland in one each.

Several German machines were seriously damaged in these encounters, and it is believed one machine was destroyed.

Paris, July 22.—One of the best of the French aviators says that the greatest service American fliers can give is in the development of team work in the air.

Recently back from the front, he declares that the German, though inferior in a man-to-man fight, has increased his effectiveness by the use of squadron formations. Germans are seldom encountered alone now. This has curtailed the scope of the enemy's activity, but made him a much more dangerous adversary.

"The French find squadron work difficult because of temperament," he said. "The French theory and practice in the air has been individualistic. An individual has the choice of when he will fly.

"The French aviator is a match for two Boches, but not for five or ten. The English and Americans must realize that the day of sportsmanship in the air is done. Air fighting cannot be played like a game. The practice of evolution in groups under the command of one 'plane is essential.

"Eight months are required to train effective fighting aviators, but half this time should be spent close to the battle lines for the purpose of observing fighting in the air and tactics."

GREAT BRITAIN

London, July 22.—London experienced its first air raid warning signals at 8:30 o'clock this morning. The city being absolutely quiet, a majority of the inhabitants were unable to distinguish the new bomb signals from gunfire, with the result that most of the population abroad ran to cover. Those still in bed made themselves as safe as possible.

The general effect seems to have been that London had all the harrowing experiences of an air raid without any necessity for it.

Signals were carried out by every fire station simultaneously with the firing of three bombs, and if London traffic were always still and it could be made possible to differentiate between the warning and the anti-aircraft fire, then the new system of signals would be an undoubted success.

The subway stations were quickly packed after the warning signals, not only with passersby but whole families in various stages of undress, some even bringing the remains of their breakfast with them and eating it on the platforms in picnic fashion. The churches were also a favorite place of refuge, those on the way thither hurrying to get inside.

London, July 22.—Another daylight raid, carried out over the east coast of England this morning, resulted in the repulse of about twenty German aeroplanes after they had dropped a number of bombs over Felixstowe and Harwich, killing eleven persons and injuring twenty-six. An alarm was sounded in London, but before the Germans could reach any point near the city they were attacked heavily by defending squadrons of aircraft, which speedily caused them to change their minds and beat a hasty retreat. One of the enemy raiders was brought down at sea.

The following official account of the raid was issued:

"A squadron of enemy aeroplanes—from fifteen to twenty-one—approached Felixstowe and Harwich at 8 o'clock this morning. Some bombs were dropped, but the heavy fire from the anti-aircraft defence caused the enemy's formation to split up, part returning overseas and part proceeding south, down the Essex coast.

"The latter party was heavily engaged by gunfire all down the Essex coast, and finally proceeded homeward without dropping more bombs.

"The raiders were pursued out to sea and heavily engaged by our aeroplanes, but the visibility was low and the difficulties of observation were very great.

"The casualties at Felixstowe and Harwich so far are eleven killed and twenty-six injured. The damage to property was insignificant."

A later statement said:

"A patrol of the Royal Flying Corps encountered some hostile machines returning to Belgium and brought down one at sea near the coast."

London, July 21.—Announcement was made in the House of Commons to-day that the British Government intends to adopt a policy of reprisal for German air raids.

England's adoption of a policy of reprisals for German air raids came after weeks of heated public discussion. The recent raids on London, which resulted in the death of hundreds of infants and women, so incensed the people that a strong movement for reprisals developed throughout Great Britain. Hall Caine, in several articles, urged the British Government to retaliate for the innocent victims of Prussian ruthlessness, holding the German mothers responsible for the raids.

"The German mother," he wrote, "has not only not discouraged air raids on London, she has rejoiced in them. Just as she held jubilee in the streets and homes of Berlin over the sinking of the Lusitania, which caused the drowning of one hundred helpless little children and brought no military advantage to the arms of her country, so (in the hope of having assisted in frightening England into submission) she will find joy in the bombing of London, knowing full well that it did nothing more helpful to Germany than to send ten little English boys and girls to the grave and fifty others to the hospital."

Many public bodies petitioned the Government on behalf of the advocated reprisal policy. Town meetings were held in different parts of the country, at which resolutions urging reprisals were passed. Although the Government had announced in the House of Commons that no new air policy would be adopted, it soon began to waver under the pressure of national opinion.

The Northcliffe press was very active in moulding this opinion. *The Daily Mail* of July 4 carried this typical editorial on the subject:

"Three weeks ago to-day fifteen German aeroplanes bombed London in broad daylight. They reached the capital unmolested, inflicted 600 casualties, mainly upon non-combatants; and then they escaped without a scratch. The German newspapers have told us—if there was any doubt on that point—that they are coming again. Their raids are to be made whenever it is convenient, and the next one is probably due.

"If the German airmen had to defend their own towns against our raids they would have no time to spare for bombing London. But so far there has not been a whisper of a single British attack on the great German cities, though there are plenty of fortresses, military headquarters and munition depots within reach of our front.

"Instead of taking action of this kind, we have spent the last three weeks in the muddle-headed discussion of a moral issue, which does not arise at all. The defence of this country against air attacks in war is not a moral, but a military question. It can be compressed into one sentence. Either we attack the Germans in their own country or they will attack us here.

"The present passive defensive system has every possible disadvantage and is unfair to the army and to the people of this country. It sets free the German aeroplanes and guns which would otherwise be required to protect the German towns, and it enables the German command without any anxiety to use them against British towns or against the British army."

Opposed to reprisals were some of the leading dignitaries of the Church and certain radical leaders. The Countess of Warwick was one of those who appealed to the masses not to heed the call for reprisals.

Not since the war began has such severe air fighting been witnessed on the British front as has taken place recently.

A little more than a week ago the Germans strongly challenged the British claim to aerial supremacy, and displayed unusual activity all along the line. The British accepted the challenge, and the result has been a succession of the most furious battles and destructive raids yet seen. Great squadrons of opposing air craft have clashed in spectacular battles among the clouds, and individual fights conducted to a finish have been numerous.

From the outset the British airmen maintained the upper hand, and today it may be said they still hold the ascendency in this branch of the service, which, as the eyes of the army, is so vital to the successful prosecution of the artillery and infantry work. Since July 12 the British have brought down at least forty-one German machines, have driven down thirty-seven others out of control, and have carried on innumerable successful bombing raids on enemy airdromes, railway stations, and other important points.

On the other hand, the British have had only twenty-eight machines listed as missing. The greatest day for the British was one on which fifteen German machines were shot to pieces and sixteen more driven to earth in a damaged condition as the outcome of terrific struggles. As against this, the British lost nine aeroplanes.

Important successes have since continued, and many thrilling stories are being related of the daring deeds performed by the allied aviators. One British machine, carrying the pilot and an observer, sighted five enemy machines flying together. Despite these odds, the British airmen dashed to the attack. Swooping in and about their opponents, they sent one Fokker crashing to earth and drove another out of control. The British pilot was killed at this stage of the fight, but the observer brought the machine home, carrying the body of his comrade with him.

Another British aviator tackled single-handed a squadron of fifteen Germans. He was soon joined by brother pilots, but he alone accounted for two German machines, after repeatedly facing what seemed sure destruction.

The official statements convey but vaguely an idea of the work now done by the airmen. Bombing raids over the enemy country are carried out in ever-increasing numbers, and damage which in the aggregate is tremendous is being done to objectives which are never mentioned to the outside world.

ITALY

Rome, July 21—Increased activity on the Julian front all the way from Vertoibizza, in the Gorizia area, to the Adriatic, is reported in to-day's official statement, which follows:

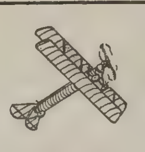
"On the Trentino and Carnia fronts there was activity on the part of the artillery and of reconnoitering detachments. In the Posina region one of our storming detachments put to flight enemy pickets, destroyed their trenches and brought back war material, including ammunition. Enemy parties which attempted to reach several of our advanced positions were repulsed.

"One of our gallant airmen attacked a squadron of five enemy machines above Oppachiasella and brought down two of them, one in flames, in our lines.

"On the Julian front the artillery fighting was more intense from Vertoibizza to the sea."

Major E. R. Perfetti, of the Royal Italian Flying Corps, who is in New York, said recently that Italy has increased her number of aeroplanes more than tenfold since her entrance into the war in 1915. From a fleet of eighty machines she now has 900. He added:

"The Italian aeroplanes are the fastest in the world—with a speed of 139 miles an hour. Italy also has the fastest seaplane, with a speed of 112 miles, and the largest machine in the world, with 900-horsepower and a carrying capacity of three tons."



MODEL NEWS

Edited by G. A. Cavanagh

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Illinois Model Aero Club News

By D. W. Pease

Still another world's record has been broken by the Illinois Model Aero Club. In a meet held at Ashburn, July 15, a record of 207.6 seconds was established for twin-propeller, hand-launched models by D. W. Pease, president of the club. The second flight was 200 seconds, and the third flight was no doubt the longest of the three, for although the model disappeared at a good altitude at the end of two minutes, it covered a much greater distance. From this it may be seen that the model was not a freak but a consistent flier.

The model used had a 36-inch motor base carrying four strands of 3/16-inch flat rubber. Twelve-inch propellers were used turning about 700 r.p.m. The elevator was 9 inches by 2½ inches, and the main wing was 26 inches by 4½ inches. The model weighed 1.6 ounces complete.

Other contestants in the meet were Sprague, Schweitzer, Likosiak, and Robbins. Likosiak and Schweitzer were both so unfortunate as to have their models collapse in mid-air, a performance more amusing to the spectators than to the owners of the models. Sprague had a rather unusual experience with his model; for it flew directly into the rapidly whirling blades of a windmill, and continued its flight without much damage.

We are very glad to welcome back to Chicago Mr. E. M. Laird, our former president. Laird just recently returned from San Antonio, where he was recovering from an accident.

Flying Kites to Study Weather

The following story, which is reprinted through the courtesy of "The Scientific American," should be of especial interest to our readers in as much as it clearly outlines some of the many uses to which kites can be put.

Everyone has heard of Ben Franklin and his kite, but few know that today a group of men out on the Nebraska prairies are still flying kites, making discoveries which may in time become quite as famed as Franklin's historical achievement. These men are professional kite fliers, belonging to the aerological division of the United States Weather Bureau. They spend their entire time on an isolated farm, studying the upper atmosphere by means of kites. On this forty-acre farm, five miles from the little towns of Elkhorn and Washington, Neb., the weather bureau is now carrying out meteorological investigations, seeking to discover the mysteries of the storms that hover over us, the insidious winds and air currents—in short, the secrets of weather. Aviation also has brought with it a greater necessity for knowledge of the upper air and the army finds an acquaintance with the caprices of the wind invaluable in artillery firing. So any one of the seven men who work days and often nights even in the coldest weather will tell you that kite flying today offers an opportunity to make some of the most useful discoveries.

This station, the only one of its kind in this country, has just celebrated its first birthday. Although as early as 1898 the weather bureau conducted some kite flying experiments in various parts of the country and for about eight years maintained a station at Mount Weather, near Washington, D. C., the work was never considered quite satisfactory. In the case of Mount Weather, the proximity of the site to the ocean and the elevation were not conducive to results which would be typical of a large part of the country. So in 1915 the government moved its entire plant to a site about eighteen miles due west of Omaha, where since December 1, 1915, regular daily flights have been made. The advantage in the present location lies in the fact that it is well in the path of all storms crossing the country. It was also the intention to make use of the army balloon plant at Omaha in sending up sounding balloons to explore higher levels than would be possible with kites, but, unfortunately, the war has cut off the supply of suitable balloons and very little of this work has been carried on.

One who desires a good idea of the aerological station should picture to himself a modest farm house, a neat granary and a stable, the whole surrounded by a clump of trees and off at one side a huge open field. The farm house serves as the headquarters of the station and furnishes the men with living accommodations. The granary has been transformed into a kite shop, but from its modest exterior one would never guess that the inside boasted an electric power plant, a laboratory, a kite factory and forty or more kites, piled high on both floors.

They are huge affairs, bearing little resemblance to the kites of boyhood days. All are of the box style, most of them 7, 8 and 9 feet square, and 2 feet 8 inches deep, designed by Hargrave, an Australian, and perfected by Prof. C. F. Marvin, chief of the weather bureau. They have a foundation of forty-one Oregon spruce sticks, carefully lashed together with coarse, waxed thread. The kite frame is braced by fifty fine piano wires running diagonally through it. One end of the kite is covered with black umbrella material and the other end with white cambric. The black part can be seen in the white clouds and the white part in the dark clouds and thus the observer can always keep his eye on the kite.

The larger kites are reserved for light winds, while the smaller aircraft are for use when the atmosphere is turbulent. The average size kite weighs about nine pounds.

Out near the center of the forty-acre field is the reel house, a little, round building mounted on a turntable. In the doorway is the reel, propelled by an electric motor and used to haul the kites down.

(To be continued.)

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

The Air Fleet

(James J. Montague in the N. Y. *American*)

A spider's web covered with canvas,
With muscles of vibrating steel,
A whirr and a hum like the roll of a drum,
And a good Yankee hand at the wheel
As frail as a gossamer mist wreath,
It seems as it floats in the air,
Like a cloud drifting by in the soft summer sky,
But wait till it gets over there!

Wait till a fleet of a thousand,
Sweeps forth like a hurricanes breath,
And the enemy flies as it send from the skies,
Its hail of destruction and death!
Watch and the war clouds will shatter,
Like mists in the warm summer sun,
For the warships of flight will go through with the flight,
Till the last of the battles is won!

The dreadnaught is far more majestic,
But it hides in the harbors away,
While the ships of the air boldly rush here and there,
Nor fear the clear light of the day.
Spider's webs covered with canvas,
But Armies will stagger and reel,
When the air squadron sweeps through the cloud scattered deeps,
With a brave Yankee hand at each wheel!

(Note—We shall send Mr. Montague a sample of aeroplane *linen.*)

"The Ford Is My Shepherd"

The Ford is my auto, I shall not want. (Another).
It maketh me to lie down beneath it.
It soureth my soul.
It leadeth me into the path of ridicule for its sake.
Yea, though I ride through the valley, I am towed up the hills.
And I fear much evil, for its rods and engine discomfort me.
I annoint my tires with patches, and my engine boileth over.
I repair my blowouts in the presence of mine enemies.
Surely if this follows me all the days of my life,
I shall dwell in the Bug-House forever.
Amen.

Taking No Chances

A young man had been in the navy for about two months, and his family had not heard from him, when one morning there came a letter, which read as follows:—

"Dear Parents:—

"I am having a wonderful time in the Navy. The officers and sailors are treating me very well, the food is excellent, and the sleeping accommodations are first class. I can say truly that I am enjoying myself completely.

Your son,
"John.

"P.S. Bill and Mike were shot this morning for complaining.
"J".

Pioneers

We happened to be down at one of the aviation fields the other day, and listening to a man talk, who sounded as if he were the Wright Brothers, Curtiss, and Langely, rolled into one. "Yes sir," he said "I have always predicted a wonderful future for the aeroplane. From its very inception in this country, I realied the immense possibilities in it, and have been working at it ever since. As president of the Nonesuch Oil Company, I placed the entire financial backing behind Bill Bump that time he made that flight from Ossining to Jersey City. I admit that most of the credit for he wonderful progress of aviation in this world is due to me."

"What did you say your name was?" we asked him.

"Abraham Z. Tinpan," he replied.

That night we got home and looked over our book of clippings from the press, chiefly the one about the epoch making flight of Bill Bump. It ran something like this:

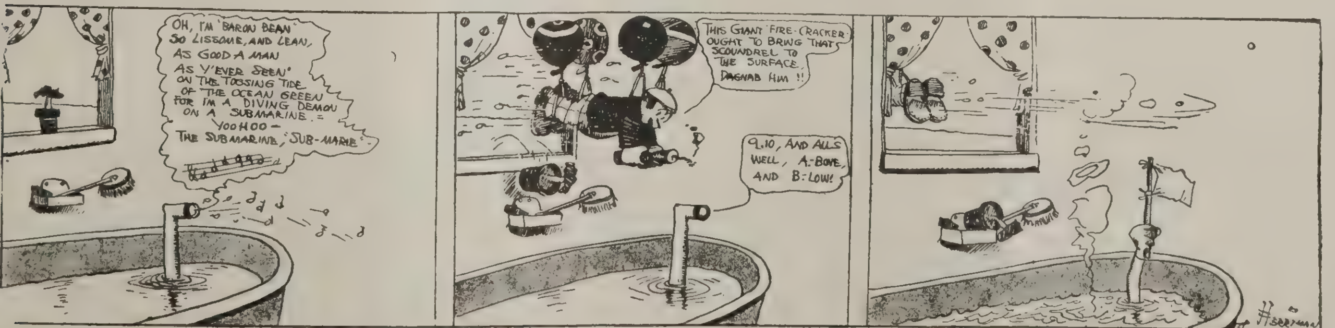
WEALTHY MAN REFUSES AID.
SEES NO FUTURE FOR AERONAUTICS.

Abraham Tinpan will not back flight project.

When seen at his home today, Abraham Z. Tinpan, President of the Nonesuch Oil Company, refused to enthuse over the chances of Bill Bump for the magnificent flight he is about to make, and would not contribute anything for the aviator's expenses, as some of the other citizens of Jersey City are doing. In answer to a question of our reporter, he spoke as follows:

"You can say that A. Z. Tinpan sees absolutely no future in the aeroplane. They are only for circus performers, and a sane man wouldn't fly one. I wouldn't give a nickle for the absolute patent rights on them!"

But now he's on the bandwagon!


OH, I'M 'BARON BEAN' SO LISSOME, AND LEAN, AS GOOD A MAN AS Y'EVER SEEN' ON THE TOSSING TIDE OF THE OCEAN GREEN FOR I'M A DIVING DEMON ON A SUBMARINE. = YOOHOO — THE SUBMARINE, 'SUB-MARIE'
THIS GIANT FIRE-CRACKER OUGHT TO BRING THAT SCOUNDREL TO THE SURFACE. DAGNAB HIM !!
9.10, AND ALLS WELL, A-BOVE, AND B-LOW!
Herriman

Courtesy N. Y. Journal

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GREAT FLEET OF U. S. AIRSHIPS IN 1918 WOULD DEFEAT GERMANY

An observer who had been at the French front in 1915, said Capt. de la Grange, of the French Aeronautic Commission, would have been extremely surprised when he returned at the end of 1916 to see the extraordinary development of French and English aviation. Instead of a few hundred machines, there were now several thousands, and they were of a new type altogether.

Those in 1915 were of the type of the actual American machines, and they are now used only for training purposes. They have been replaced by machines with motors of 130 and 150 horsepower, instead of 80 and 100 horsepower, and their speed, instead of being from 50 to 70 miles an hour, now attains 100, and even 130 miles an hour for fast fighting machines. All of them are armed with one or two machine guns, and some with guns comparable to the light navy guns.

Models Rapidly Change

Aviation progresses so rapidly on the battle fronts, Capt. de la Grange explained, and the competition between the two sides to get the best machine there is soon made the material used in 1915 out of date. He pointed out that inadequate machines are almost as bad as no machines, and, from the point of view of many aviators, worse. Since 1915, he said, the Allies have made great progress with their machines, yet even now their planes are hardly sufficient for all that is required of them.

There is something very awkward about the industry that makes aeroplanes, he went on. All the material must be built in series and each time a new series is decided upon it takes several months to begin construction. Very often when certain type of machine has been used for a short time a better type is found and it is necessary to construct this new type. If there is any hesitation about doing this and the old model is clung to, in a few months the aviators lose their superiority over the enemy which it had previously acquired. It is this problem which the French aviators had to meet at the end of 1916. In order to have in 1915-16 1,500 machines on the front and 3,000 in the schools, the French factories had to make a tremendous effort. They were hindered by the lack of raw material and by the difficulty in procuring labor, therefore the machines which they turned out were not of the newest design and the result was that at the end of 1916 the French aviation was not homogeneous.

The spotting machines and the reconnaissance machines were not of the newest type, they did not climb fast enough, nor did they have enough speed horizontally, and they were insufficiently armed. On the other hand, very luckily, the fighting machines were very superior to the enemy machines. Therefore, in 1916-1917, the allied fighting machines were everywhere the strongest and were able to keep the command of the air, but their task is overwhelming because they are too few. The Germans managed to slip through the meshes of the net of protection which had been formed and they attacked the spotting machines, who could with difficulty defend themselves. This resulted in losses on both sides. The Germans lost their fighting machines because they were less good than ours; the allies their helpless spoting machines. It is difficult to protect these last because of the conditions under which fighting in the air takes place. Attacks may come from all sides, above, below, and from the side. There is a double remedy to this, either to have a very large number of fighting machines of the best model or to improve the spotting machines, making them faster, arming them better, so that they may defend themselves. The allies are trying both these remedies, but it is difficult for them to make a great industrial effort, as their factories have been working at top speed for the last three years.

The United States, with their great industrial production, will be able finally to overcome these difficulties.

Air Forces Perceptibly Equal

If we keep in mind what has been said above, we realize that forces actually now taking part in the gigantic struggle are perceptibly equal. There are about 3,000 allied aeroplanes against the same number of Germans. Imagine what would happen if America suddenly threw in the balance 4,000 or 5,000 more aeroplanes in 1918. This would mean that there would be against each German aeroplane two or three allied ones, and if during an attack the allies concentrated their aerial forces there could be five or six allied machines to one German in the area where the attack was being carried on. This would establish the absolute superiority of the allied aviation. The German machines would be obliged to stay behind their lines and would be attacked over their own aerodromes. The allied spotting machines would be able to do their work in absolute security far in the German lines, and could therefore direct the firing very accurately and save a great deal of ammunition.

The result of all this would be that we would have a great deal of information of all that was being done back of the German lines while our adversaries would know nothing of what we were preparing.

In one word, this would mean the absolute air supremacy with all its advantages; the blinding of the enemy, the precision of our artillery fire, which would have a double advantage—it would save ammunition and also save many of our soldiers' lives. This was proved in 1916 at the beginning of the Battle of the Somme.

If the front was pierced and the enemy was forced to retreat, it would be as disastrous to them now as it would have been in the old days for an army to retreat without cavalry in the face of an enemy having a powerful cavalry. The aviation is the cavalry of modern time.

Will Secure Victory

The intervention of the United States in 1918 with a great and powerful aviation would, without doubt, secure the victory of the Allies. This would be a decisive victory—a victory of democracy over autocracy. If this victory was not decisive, the question would be brought up again in 10 years, and would then probably be fought out not in Europe but on the American soil.

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F. C. G. EDEN, formerly in charge of the Dodge School of Aviation.

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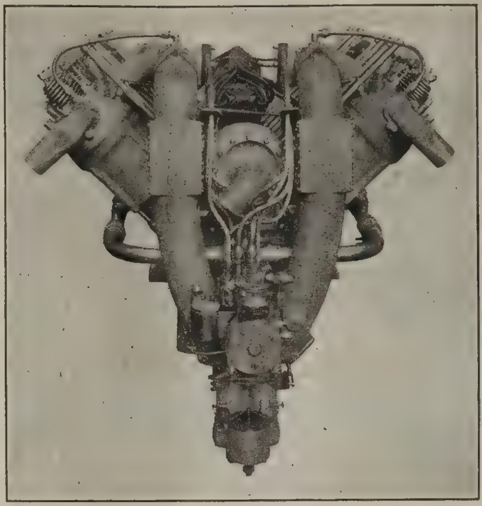

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THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

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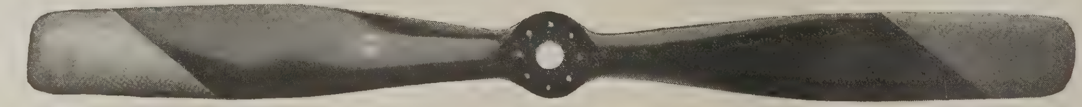

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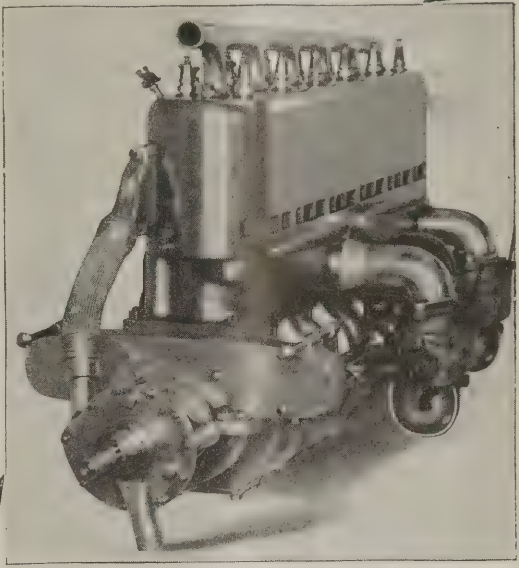

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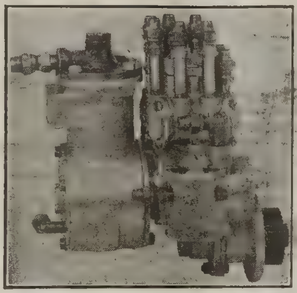

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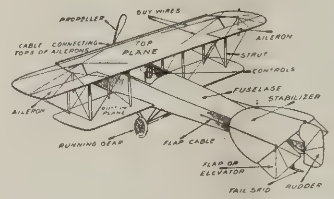

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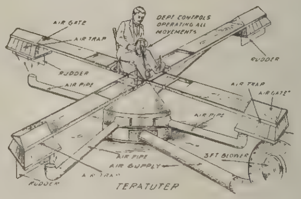

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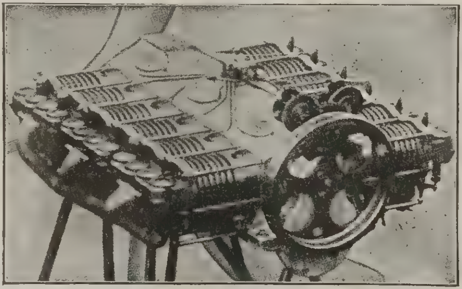

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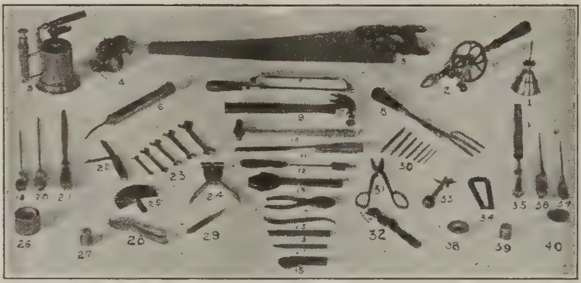

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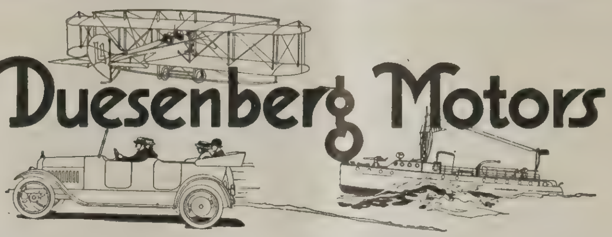

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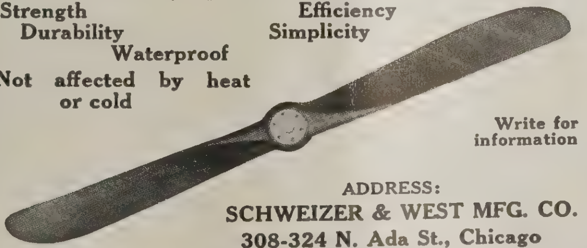

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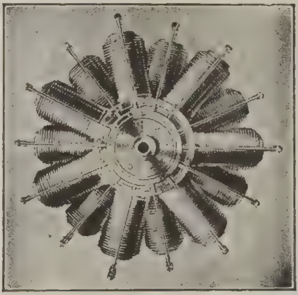

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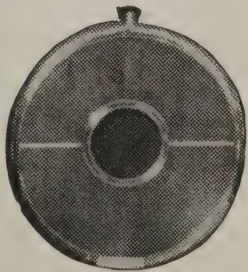

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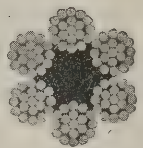

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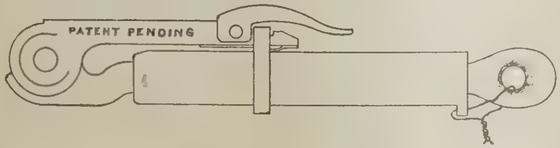

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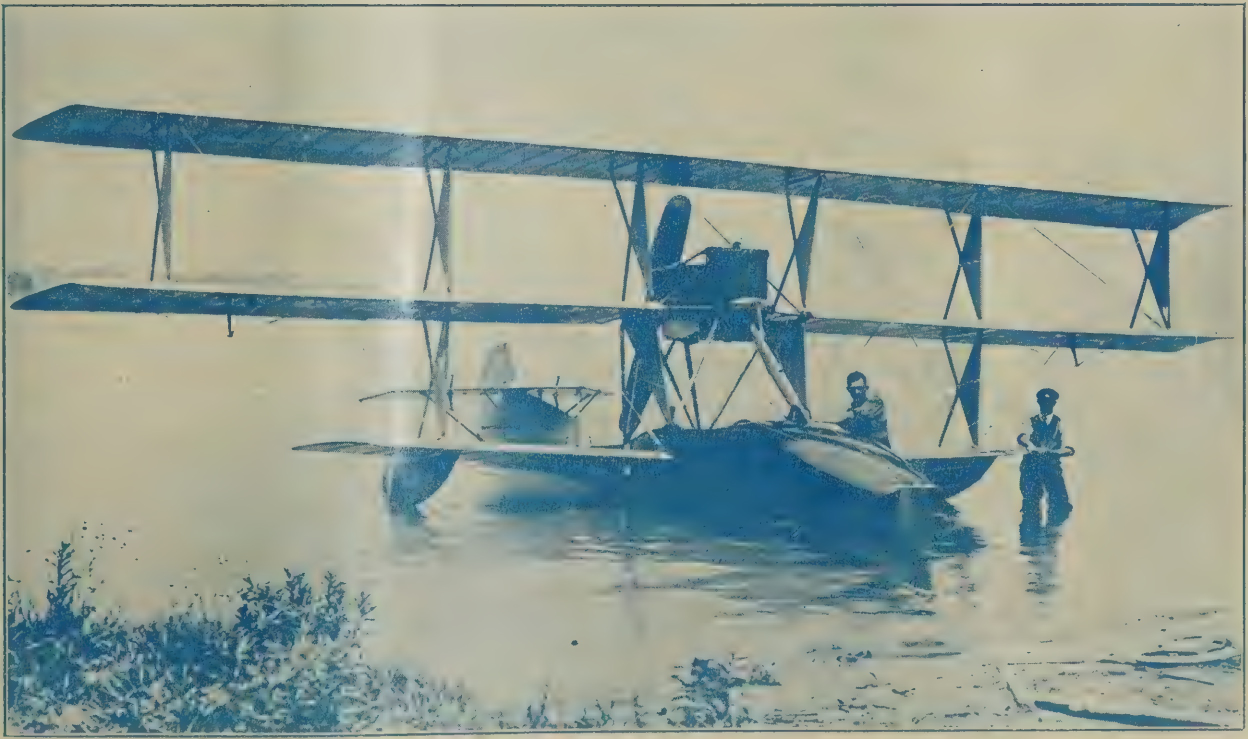
AERIAL AGE
WEEKLY

Vol. 5, No. 21 AUGUST 6, 1917 10 CENTS A COPY



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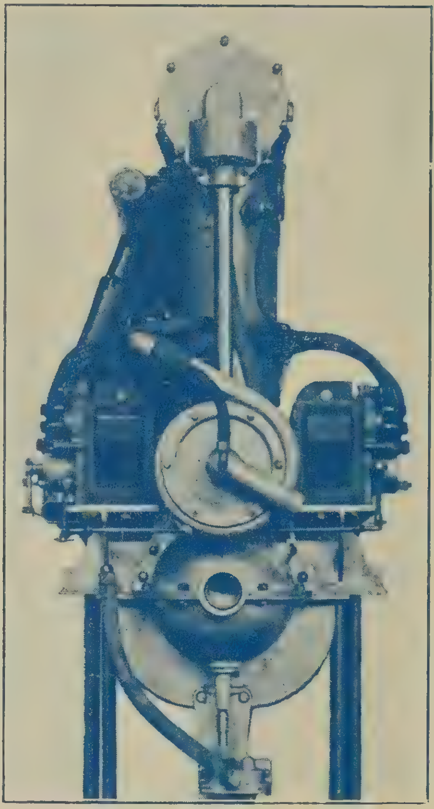

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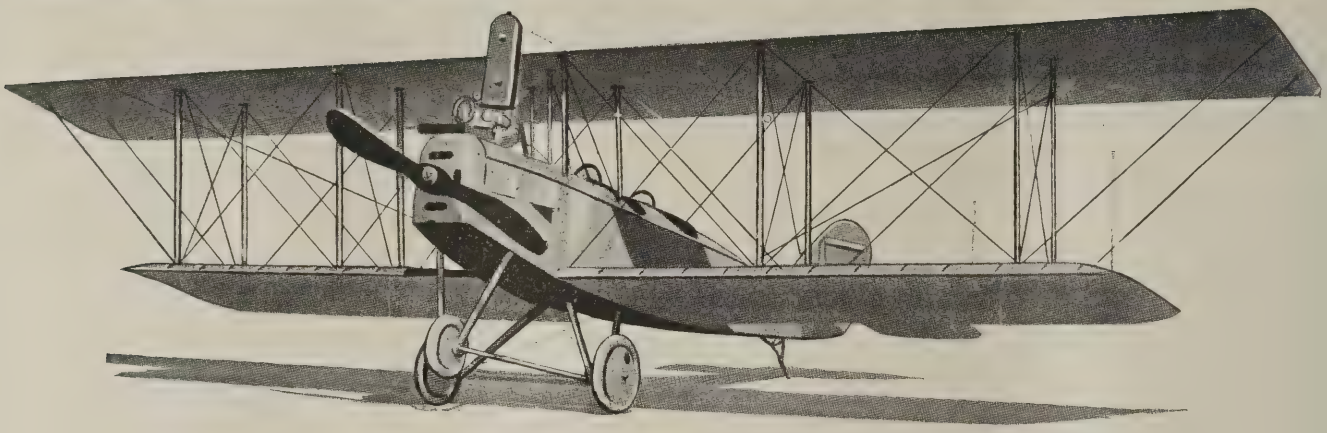

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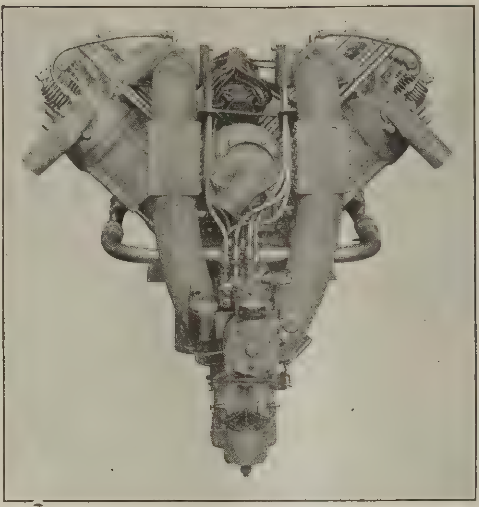

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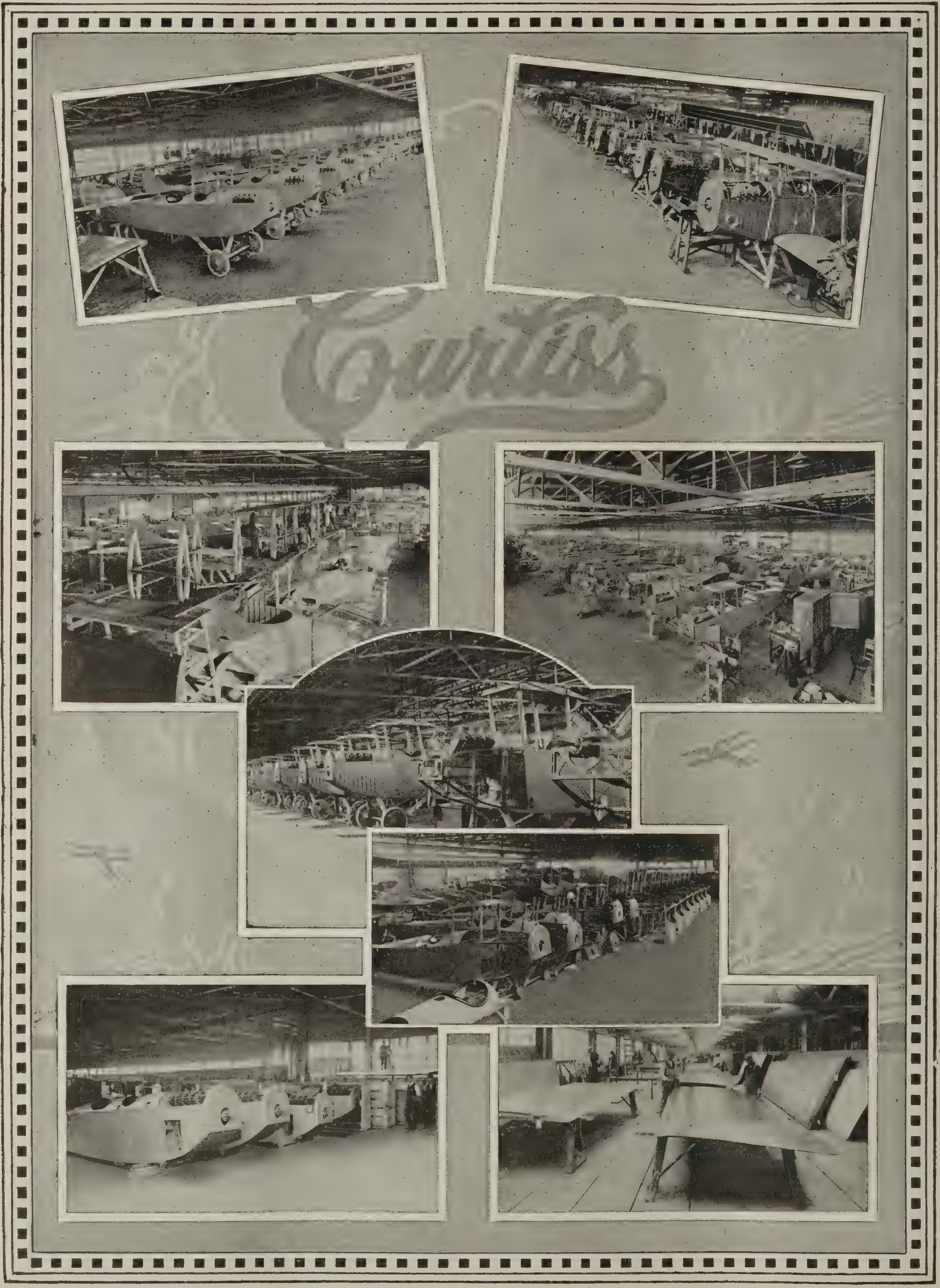

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VOL. V NEW YORK, AUGUST 6, 1917 No. 21

THE AIRCRAFT PRODUCTION BOARD'S SPLENDID RECORD

THE Aircraft Production Board has been doing splendid work and deserves the hearty praises and backing of the nation as a whole.

Chairman Coffin is right. The only real mistake that the Board could make would be to lose time in building our aerial forces. As every day lost in crushing Germany means the loss to the Allies of 5,000 lives and $500,000,000 in actual costs and wreckage, the only mistake that can be made is to not have a large enough program or to lose time in carrying out such a program. Everything else is unimportant in comparison. While it is true that consideration will have to be given to develop special types of machines and motors, it is also true that there will be needed thousands of training machines and large bombing machines, and that every factory available can be kept busy for a year to come in turning out these machines.

The Allies concur with us in that the United States has good training machines, therefore no mistake can be made in placing orders for thousands of these—as the Aircraft Production Board and the War Department have been doing.

Nor can a mistake be made in ordering thousands of large warplanes of the Caproni, Handley Page, Curtiss, Gallaudet or other types, the blue prints of which are available.

The Germans by their aeroplane raids on London and Paris, have demonstrated that some fairly good warplanes on hand are better than the very best air cruisers far away. The Allies have, of course, a number of large Caproni and Handley-Page warplanes and fleets of small fighting machines and could have done short work of the squadron of German Gotha bombing machines that participated in the raids. But the Germans came out of the blue sky, dropped their bombs and were away before the Allies' machines could reach them. Three Germans were brought down only because they flew low. At night they are usually successful in getting away unharmed.

We must learn from this lesson that the only thing that counts is the aeroplanes that we actually have to send out to make night attacks on the German naval bases and military centers. Any type of warplane capable of 600 miles continuous flight is suitable for this purpose—and success depends on the number available rather than whether it is the ultimate best or not.

We can develop the ultimate best while the available best are bombing the German bases and are training thousands of aviators.

Baker and Daniels Favor Extended Air Board

The Sheppard-Hulbert bill, providing for a separate department of aeronautics was presented again to the Senate Military Affairs Committee on July 27 in a revised form. The bill now provides for the delegation of full authority to the aircraft production board of the Council of National Defence to direct the expenditure of the $640,000,000 recently appropriated by Congress for America's air fleet. The proposal has the approval of Secretary of War Baker, Secretary of the Navy Daniels and Howard E. Coffin, chairman of the aircraft production board.

Senator Sheppard, according to an announcement of Representative Hulbert to-day, will urge immediate consideration of the measure by the Senate Military Affairs Committee.

The proposal to vest direction of the aircraft production programme in the aircraft board of the Council of Defence was offered in both the House and Senate as an amendment to the aero bill. However, there was no vigorous championship of the amendment on either side, and it was perfunctorily defeated. This was explained by the inaction of members of the aircraft production board and their unwillingness to urge legislation giving themselves enlarged governmental powers.

Lieut. F. T. Davison

The country at large was thankful that Lieut. F. T. Davison was not severely hurt in his recent accident. His patriotic work, by setting the example for other wealthy young men to follow, has been of great value to the nation. The thirty aviators of the Aerial Coast Patrol Unit organized by Lieutenant Davison are a valuable asset to the nation.

So we are thankful that he was not seriously hurt

Aero Club of America and Aerial League of America Participate in State Campaign

Governor Whitman has formally authorized a great patriotic speaking tour to be conducted in this State during September, when the selective draft becomes operative and when the second Liberty Loan campaign will probably be in progress. This action was taken by the Governor upon the urgent request of a number of the prominent patriotic organizations, and upon the advice of Dr. Henry Noble MacCracken, President of Vassar, now Chief of the Division of Instruction, State Council of Defense.

The purpose of this campaign is to inform the people of the state as to the underlying causes of the war, the need of getting every person to support the Goverment's program to fight the war to a successful end, and what the American people may reasonably expect to be the outgrowth of this great struggle for democracy.

It is proposed to have ten teams of four speakers each to deliver addresses in the principal centers in every county throughout the state. The speakers will include many of the most prominent men in national life and will be chosen from lists submitted to the Division of Instruction by the following organizations: The Liberty Loan Committee; the National Security League; the League to Enforce Peace; the American Red Cross; the Aero Club of America; the Army League, the Navy League and the Aerial League of America.

On Monday morning, July 30th, at 10:30 a. m., the official state organization car, loaned for the trip by the Westcott Motor Car Company, left from in front of the Pine Street headquarters of the National Security League on its trip throughout the state. In the car was Bennett E. Tousley, recording secretary of the Aerial League of America, who has been selected by the Division of Instruction and the organizations supporting this project to organize the state for this campaign.

Telegrams have been sent from Albany to the Chairman of the Governor's Home Defense Committees in every county, asking them to arrange meetings of their Committees at which Mr. Tousley will appear to outline the plan of campaign and to enlist the co-operation of the local Committee.

The slogan of this world-wind organization tour will be "Sixty Counties in Thirty Days"—it being necessary for Mr. Tousley to visit and organize two counties a day until the end of the campaign.

Hall Caine's Message to the United States

Hall Caine has sent a vigorous message to the United States. We quote in part:

"Perhaps I have no such technical knowledge as would justify me in criticising the apparent unreadiness or inadequacy of our air defenses, but fresh from the scenes I have described I do not shrink from warning the Government to take heed of the present mood of our people, particularly our women, and, above all, our mothers. They know we are at war, and as long as it is fair fighting they are ready to pay the price of battle, but when it is not war but murder, the murder of their helpless children, they will not long be content to sit silent with their arms tied behind their backs.

Finally, I venture to call upon our great new ally, America, to speed up the manufacture of her aircraft and the training of her airmen, and let us have both without delay, so that in the name of humanity and civilization we may put an end forever to this brutal bullying by cowards who have dragged down the great name of soldier to the lowest depths of infamy.

Is not that what this war is for, to us and to our Allies, the only thing that justifies it? If our enemies have the right to bomb London, then all Europe is a battlefield and not better than the kingdom of the devil, and what is the use of discussing questions of peace and annexation and indemnity until this first great question has been solved?

Aero Club of America Endorses Congressman Hulbert's Excellent Work

The following letter was sent by Mr. Alan R. Hawley, the president of the Aero Club of America, to Congressman Murray Hulbert and to the other Senators and Congressmen who have labored so assiduously in the interest of aeronautics and to whose splendid and patriotic efforts are so largely due the passing of the aeronautic appropriation of $640,000,000 for the Army.

President Hawley's letter reads as follows:

"My dear Mr. Hulbert:

"The Aero Club of America wishes to express its heartfelt thanks to you for the patriotic work you did in getting through Congress the appropriation of $640,000,000 for aeronautics for the Army. The nation owes you a debt of gratitude for your work, and it will realize its debt more clearly as time goes on.

"The Aero Club now wishes to express the hope that you will be able to induce Congress to appropriate a sum at least equal for aeronautics for the Navy. The people feel that the Navy is as important for the safety of the country as the Army, and that aeronautics can assist naval operations as effectively as it can military operations.

"In fact, when one considers the long distances that naval aircraft must traverse, and sees that they are much longer than the distances that military aircraft fly over, one realizes that aircraft used by the Navy must be more powerful than those used for the Army, and must, therefore, cost more money for each machine. And not only must each machine be larger, but there must be a greater number of machines; since greater areas must be covered.

"This general truth has special application at the present time, when the commerce of all the world is threatened by the German submarines; when, in fact, the daily destruction of commerce is so tremendous, and apparently going to so continue, that unless some cure is effected, the Allied cause will probably be lost. The only cure proposed that seems to have any reasonable prospect of success, is the aeronautic cure; and this cannot be effective unless it is carried on by major operations with thousands of aeroplanes.

"Knowing that you realize that all these things are true, and hoping that you will be able to make your Congressional colleagues realize them also, I have the honor to be, dear sir,

"Yours very truly,
"(Signed) Alan R. Hawley,
"President, Aero Club of America."

Expedition To Assist Spruce Lumber Production

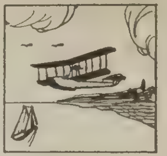
To arouse enthusiasm and loyal co-operation of spruce producers of the Pacific coast in the aircraft plans of the Government and to counteract reported efforts of the I. W. W. to tie up the spruce mills as an anti-war measure, the Government is going to send an expedition to the coast next week.

In the delegation, which will take motion pictures of battle scenes with them to educate the people to the requirements of the war will be representatives of the Federal Government, the British, French and Italian missions, American aircraft manufacturers and Pacific coast spruce lumber men. The itinerary includes Seattle, Tacoma, Portland and other coast towns in Washington and Oregon and probably San Francisco.

The delegation will be composed of E. T. Allen of the lumber committee; Lieut.-Col. Rees of the British Royal Flying Corps, Major Perfetti of the Italian mission, Capt. Dourif of the French mission and a representative of the Aircraft Manufacturers and H E. Jayne and F. A. Douty, representatives of the spruce lumber men.

Mr. Charles R. Sligh, of the Aircraft Production Board, is to be congratulated for his able and energetic efforts to solve the spruce lumber question.

THE NEWS OF THE WEEK



Delegation of Aircraft Men to Visit the Pacific Coast

A delegation composed of representatives of the Federal Government, the British, French, and Italian missions, American aircraft manufacturers, and Pacific Coast spruce lumbermen will leave early next week for the Pacific Coast to confer with lumber manufacturers for the purpose of obtaining their co-operation in turning out the quantities of spruce needed for the aircraft program of the United States and the allies. At the same time the members of the delegation will deliver a series of addresses in the coast cities and towns on the war situation. The trip will be made under the auspices of the aircraft production board and the Signal Corps.

The delegation will be composed of E. T. Allen, of the lumber committee of the Council of National Defense, who will represent the aircraft board; Lieut. Col. L. W. B. Rees, of the British Royal Flying Corps; Major R. Perfetti, of the Italian mission; Capt. Henry Dourif, of the French mission; a representative of the aircraft manufacturers, and Howard E. Jayne and F. A. Douty, representatives of the spruce lumbermen.

They will take with them a series of moving pictures showing work at the front and will talk to the public on recent war developments, urging general co-operation in all war activities.

The schedule of the trip includes stops at Seattle, Tacoma, Portland, various other coast towns in Oregon and Washington, and possibly at San Francisco.

The aircraft production board states that even with the improved specifications proposed by the spruce manufacturers at their recent conference with Government representatives, which require more careful selection and less raw material than those in common use, it is estimated that the demands of the joint allied and American program will still call for far larger amounts of spruce than were manufactured last year. Although this will require an unusual output by the spruce manufacturers, both on the Pacific Coast and in North Carolina and Virginia, where part of the supply can be obtained, it is regarded as by no means impossible.

Experts Open Inquiry Into New Anti-Aircraft Fire Control in Forts

Washington—War Department artillery experts were ordered by Secretary of War Baker to visit the coast defenses at Fort Monroe, Va., and investigate and report on the anti-aircraft fire control system now being installed there.

The board is composed of Major Elmer J. Wallace, Coast Artillery Corps; Major Charles T. Richardson, Ordnance Department; Captain Jacob M. Coward, Coast Artillery Corps, and Captain George R. Allen, Field Artillery.

It will compile for the War College information about the coast defense armament and the fire-control system of anti-aircraft guns to be employed by field artillery units.

J. F. Victory, Assistant Secretary and Special Disbursing Agent of the National Advisory Committee for Aeronautics

$2,000 for Aero Fund

A benefit performance for the aviation fund to supply equipment to the United States Flying Corps in France, given recently in the Glen Theatre at Glen Cove, was attended by nearly every family of the fashionable North Shore colony. The receipts aggregated more than $2,000.

Among the patronesses were Mrs. Theodore Roosevelt, Mrs. Henry P. Davison, Mrs. Paul D. Cravath, Mrs. William D. Guthrie, Mrs. Harry Payne Whitney, Mrs. Frederic R. Coudert, Mrs. Frances L. Hine, Mrs. C. K. G. Billings and Mrs. Lewis Cass Ledyard, Jr.

Alan R. Hawley, president of the Aero Club of America, delivered an address, and among the authorities present were Henry Woodhouse, Col. C. F. Hartmann, Col. Stewart, Canadian Recruiting Officer, Mr. Wm. A. Bartlett, Chairman Aviation Committee National Special Aid Society. Many theatrical stars, brought together by George M. Cohan and William Collier, lent their aid. Among them were Andrew Mack, Stella Mayhew, Billie Taylor, Nora Bayes, Irving Fisher and William Collier, Jr.

Offer Spruce for Aeroplanes at $105 per Thousand Feet

As a result of a conference held here for the past three days between authorized representatives of spruce manufacturers of Oregon and Washington and representatives of the Signal Corps, the Aircraft Production Board, the British, French, and Italian missions now in Washington, and the lumber committee of the National Council of Defense, Howard E. Jayne and F. A. Douty, of Oregon, proposed on behalf of the spruce men to furnish aircraft spruce for the coming year's big programe at $105 per 1,000 feet. This price is about one-half that which has been paid up to now by many of the aeroplane manufacturers. The price applies to the allies needs as well as to those of the United States.

If it is finally approved by Government authorities it will, in the opinion of the lumber committee, unquestionably result in a big saving on spruce requirements.

The specifications which have been proposed by the spruce men and which received the informal approval of the Government's representatives present are as follows:

Thickness.—2 inches to 6 inches, inclusive. At least 60 per cent to be 3 inches and 4 inches thick. Not more than 40 per cent 2 inches, 5 inches, and 6 inches thick.

Width.—All to be 4 inches and wider; not over 10 per cent under 5 inches wide.

Length.—Fifty per cent to be 19 feet and longer. Fifty per cent to be 4 feet and longer.

Measurement.—Width and thickness fractional. Lengths in multiples of 1 foot.

Grain.—All lumber 3 inches and thicker shall be not less than 70 per cent vertical grain of an angle of 45° to 90° on each carload. All lumber 2 inches thick shall be not less than 30 per cent vertical grain of an angle of 45° to 90° on each carload.

Grades.—The grades agreed to are as follows:

The 50 per cent of all lumber 18 feet and longer shall be clear four sides, straight grained, not less than six annular growth rings for each 1 inch, sound and well manufactured, free from shakes, spiral and curly grain.

This grade will admit of bright sap, wane, pinworm holes, slight variations in sawing, or other defects that will not impair its use for wing beams.

The 50 per cent of all lumber 4 feet and longer shall yield clear cuttings, straight grained, not less than six annular growth rings per each 1 inch, sound and well manufactured, free from shake, spiral, and curly grain; some may contain knots, pitch pockets, wane, pinworm holes, slight variations in sawing, and other defects that will not impair its use for the purpose intended, providing, however, that each piece must produce, for buyer, clear straight grain, cuttings from 4-foot to 17-foot lengths, which shall not include over 5 per cent of such cuttings 4 feet to 7 feet inclusive.

The First Aero Division of the Fourth Battalion, N. M. N. Y., stationed at Poughkeepsie, With J. B. R. Verplanck, the Veteran Aviator, in command.

Professor Lionel S. Marks to Cooperate

The National Advisory Committee for Aeronautics has just secured for an indefinite period the services of Professor Lionel S. Marks, head of the combined departments of Mechanical Engineering of Harvard University and Massachusetts Institute of Technology. He will be assigned to assist in the special work of the Subcommittee on Power Plants, and will have charge of certain investigations relating to airplane engine design conducted by this committee at the Bureau of Standards.

Professor Marks is a recognized expert in therodynamics, engine cycles, and particularly the gas engine, and is probably the best qualified man in the country to supervise the important investigations proposed.

Air Boards Here and Abroad to Examine Military Aviators

Washington — The War Department made an announcement of a board of army officers, to meet in Paris at the call of the senior officer on the board, for the purpose of examining such officers as may appear before it to determine their fitness for rating as junior military aviators. This is a step toward obtaining American military aviators from among Americans now abroad.

The board consists of Lieut. Col. William Mitchell of the Aviation Section of the Signal Corps; Captain Millard F. Harmon, Jr., junior military aviator, and Captain Davenport Johnson, also a junior military aviator.

A second board has been appointed to meet for the same purpose in Washington. It consists of Major Henry H. Arnold, Captain Henry W. Harms, and Captain Lewis H. Brereton, all junior military aviators.

California Aviation Co. Organized

California Aviation Co., Los Angeles, recently incorporated with a capital of $600,000, is planning for the immediate operation of a plant for the manufacture of aeroplanes. The company has acquired property at Vernon and will specialize during the coming months in the production of training machines for Government service and training schools. The present capacity will be one finished machine a day, to be increased to about ten with the installation of proposed machinery.

New L. W. F. Factory

L. W. F. Mfg. Co., College Point, L. I., will establish a branch factory at Long Island City for the manufacture of biplanes.

Aluminum from Kaolin

New York.—Owing to the enormous increase in the demand for aluminum for airplanes and automobiles, it may be found necessary to produce this metal from kaolin or fire clay in the future, instead of from bauxite, its present source. This prediction is made by Dr. F. C. Weber, a Chicago industrial chemist. Germany has been obtaining aluminum from kaolin since its supply of French bauxite was cut off. According to Dr. Weber, this country's supply of kaolin is practically inexhaustible. The largest deposits are in Illinois. Weber has submitted his theory to the Society of Industrial Engineers, which, in turn, will take it up with the Council of National Defense.

Captain Arthur Read Christie, Who is in Charge of the Wilbur Wright Aviation Field, and Mrs. Christie

Personal Pars

Mr. P. C. Christman, for the past three years district manager and sales engineer for the Burd Ring Sales Co., has resigned and become vice-president and general manager of the Gill Piston Ring Company, offices at 1864 Broadway, New York.

Trustees of Ohio State University On the Recent Visit to Wilbur Wright Aviation Field. Reading from Left to Right They Are John F. Cunningham, Cleveland; John Kaiser, Marrieta; Charles F. Kettering, Dayton; Judge B. F. McCann, Dayton; O. E. Bradfute, Xenia; President W. O. Thompson, Columbus; Guy W. Mallon, Cincinnati; Julius F. Stone, Columbus, and Secretary Carl E. Steeb, Columbus

Aeronautic Observers Wanted

It is desired to obtain in service in the Aviation Section, Signal Officers' Reserve Corps, men qualified for training and commission as observers from airplanes. Candidates for this position should be from twenty-five to thirty-five years of age, should have a good education and be physically fit. Keen eyesight is essential. Ability to draw, and judge distances are desirable features. He should be well balanced and have good judgment, and if possible previous military experience.

It will be the intention to assign successful candidates to a school for a period of instruction of from three to four months. This course of instruction will cover study of artillery, fire from aeroplanes; reconnaissance, radio, and bomb dropping.

Candidates who desire to make application for this position should write to Airplane Division, Chief Signal Officer, War Department, Washington, D. C., who will furnish them the necessary information and blanks for making application to take examination.

Candidates who complete the course successfully will be commissioned as First Lieutenant, and will be eligible for promotion. The pay carried by this commission is $2,000 per year with an increase of 25% when engaged in the duty of observation officer.

Marshonet Resigns From United Eastern Aeroplane Co.

Edward F. Marshonet, of Hempstead, L. I., has resigned as president of the United Eastern Aeroplane Corporation. Mr. Marshonet was the engineer and designer, having complete charge of the factory, producing military tractor biplanes used in the school conducted by company at Sheepshead Bay Speedway.

Home for U. S. Flyers in Paris

"The Bright Corner in Paris" is the name chosen for the house in Paris that is to be fitted up for American aviators serving under Old Glory or with the Allies. Mrs. William Allen Bartlett, chairman of the aviation committee of the National Special Aid Society, and her associates have made all arrangements for opening this retreat in the near future. Mrs. Henry Clarke Coe, wife of Major Coe, U. S. Army, will sail for France in a few days and will officially take charge of the house.

The purpose is that American aviators when in Paris will have a place that they can call home. All comforts possible in war time will be provided for them in the hours of their furloughs, and while there they can make it headquarters and get off their home letters.

Among those interested in the project are Rear Admiral Bradley A. Fiske, retired; Col. C. E. Bradley, Major-Gen. Gorgas and many others equally prominent.

Prize Offered for Aviator Poster

The Aviation Committee of the National Special Aid Society, of No. 259 Fifth Avenue, yesterday announced that a prize in gold will be warded to the person designing the gest original poster of its new book, which is to be called the "National Enrolment of American Patriots to Help the Wings of the United States." The book has been made by Dr. George F. Kunz and has been presented to Mrs. William Allen Bartlett, chairman of the Aviation Committee.

All patriots who pledge themselves to aid the aviators of this country may be enrolled in the book. The first enrolments will be taken during the performance of opera to be given by Columbia University, July 17. The book will be placed in the foyer of the university gymnasium and will be in charge of members of the Aviation Committee. Each enrolment will be for any sum the person signing desires to give. And each will receive a bronze medal. When the book is filled it will be presented to the Library of Congress at Washington.

A committee of artists will pass on the poster designs submitted. The Aero Club of America is co-operating with the Aviation Committtee in this work.

Army and Navy Orders

Capt. Frank T. Coffyn, Av. Sec., S.O.R.C., to duty at Mineola, N. Y. (July 17, War D.)

Capt. W. A. Smith, jr., Av. Sec., S.O.R.C., to report in person to C.S.O. for duty. (July 18, War D.)

First Lieut. W. E. Farnell, Av. Sec., S.O.R.C., to duty at Wilbur Wright Field, Fairfield, Ohio. (July 17, War D.)

First Lieut. B. A. Law, Av. Sec., S.O.R.C., to duty at San Diego. (July 17, War D.)

First Lieuts. F. H. Harvey and A. L. Richmond, Av. Sec., S. O. R. C., to duty at San Antonio. (July 17, War D.)

First Lieut. G. L. Tillbrook, Av. Sec., S. O. R. C., to duty with 10th Aero Squadron, Rantoul, Ill., as supply officer. (July 17, War D.)

Officers of A.S., S.O.R.C., to duty as follows: Capt. G. Stevens to Mount Clemens, Mich.; 1st Lieut. J. F. Doherty to Mineola, N. Y.; 1st Lieut. F. F. Bell to Essington, Pa.; 1st Lieut. P. L. Caldwell to Boston, Mass.; 1st Lieut. G. W. Muller to Rantoul, Ill. (July 20, War D.)

Captains of A.S., S.O.R.C., to duty as follows: A. Gosling and M. Connolly to Rantoul, Ill.; C. Chester to Chicago. (July 20, War D.)

Capt. Pierre De L. Boal, A.S., S.O.R.C., to Washington duty. (July 18, War D.)

Capt. Henry P. Van Keuren, S.O.R.C., to duty, Washington. (July 19, War D.)

First Lieut. Eugene L. Deacon, S.O.R.C., to Fort Sam Houston, duty. (July 19, War D.)

First Lieut. C. S. Lyon, A. S., S.O.R.C., to duty, Mineola, N. Y. (July 19, War D.)

First Lieut. Joe G. Tress, A.S., S.O.R.C., to duty at Fort Sam Houston. (July 19, War D.)

Officers of A.S., S.C., to duty as follows: First Lieuts. W. C. Douglas to Rantoul, Ill.; Carroll Dunham, 3d, to Washington, D. G. Frost to Mount Clemens, Mich., and K. H. Condit to School of Military Aeronautics, Princeton, N. J. (July 19, War D.)

First Lieut. David H. Young, A. S., S.O.R.C., to Fort Sam Houston for duty. (July 21, War D.)

First Lieutenants of Av. Sec., S.O.R.C., to duty as follows: T. C. Knight to Mineola, N. Y., H. W. Schulz to Fort Sam Houston, E. P. Hinds to Rantoul, Ill., C. A. Wall to Mineola, N. Y., and W. A. Fox to Fort Sam Houston. (July 20, War D.)

The extent of construction operation involved in the establishment of a typical aviation training field may be gathered from the following list, which shows the buildings to be erected at the Rantoul, Ill., site: Eighteen hangars, 66 x 120; ten officers' quarters, 24 x 124; one commanding officers' residence, 25 x 31; one officers' clubhouse, 40 x 70; one hospital, 78 x 118; six mess halls, 20 x 118 each; six cantonments (barracks), 20 x 336 each; one power house, 35 x 37; one gymnasium; two latrines; one guard house; one school house, 96 x 200; one supply building, 66 x 125; one administration building, 40 x 80; one gasoline storage 35 x 62; one blacksmith shop, 26 x 60; one garage, 66 x 201; one machine shop, 65 x 125; one post exchange, 40 x 62; one Y.M.C.A. building.

To Enter Germany By Air Route

Washington, July 25.—Brig. Gen. Squier, Chief of the Army Signal Corps, invites the public to allow him to carry out the American aviation programme secretly so that the German military machine may be taken by surprise and may not have an opportunity of preparing for every move made by this country.

Incidentally, Gen. Squier advises the public that an aviation army big enough to be felt in the war cannot be outlined in the fashion that business plans are formed because no one knows from day to day what new development may brush aside all that had been planned. He explains that the $640,000,000 appropriated by Congress is only a beginning, and that is is impossible at this time to say how many machines or what types that sum will buy.

"I am not here to make public our plans or to indulge in prophetic figures," he said today. "The closest estimate I can give is about this: That the Allied Governments have determined to enter Germany by the air route and the United States Government is going to provide enough machines to make itself felt in putting this programme through.

"That is not saying that we will construct 22,000 aeroplanes or 1,000,000 or ten or a dozen. If I knew how many machines we would or could construct in a year I wouldn't tell, because it would be telling von Hindenburg, and he'd thank us for the information. The best time to tell the enemy about any military programme is after that programme has been carried out.

"Germany announced her 42-centimetre guns by hauling them up to the battle line and firing shells of hitherto unheard of calibre into Belgium. After the guns were built and placed in operation she encouraged the press in glorifying the results. The Germans are a nation of press agents, but they never let publicity tamper with a Government secret.

Major W. G. Kilner, in charge of the Mineola Aviation School

$640,000,000 Will Be Spent

"Of course the pubic wants to know what we are going to do with the $640,000,000 which Congress appropriated for the aviation service. Well, it's safe to say that we will spend that money and probably much more on the air route into Germany. That's about all we are going to say.

"Civilians are continually asking, 'What are your plans?' It's hard to convince some business men that an efficient military programme is not a plan, but many plans. It ought to include all the plans there are in order to meet and defeat the fellow on the other side of the firing line, and you may be sure he has not been advertising his intentions.

"The public ought to be educated in the psychology of war, to be taught the swift opportunism which must be employed in carrying out any great military enterprise. The essence of strategy is surprise. In many respects war is the polar opposite of regular business, as business is generally considered. The captain of industry schemes out his work, sometimes looking years ahead. He plans to operate in settled communities, or communities whose growth and condition can be fairly well calculated. But the very spirit of warfare is shift, change, impermanency. A General on the field is working against a hidden foe whose science and wit are constantly employed for the wrecking of that General's plans.

"How, then, could I say, if I would, what America's aviation programme will be for the next six months or a year? If you will show me Von Hindenburg's provision for air attack during the coming winter and spring, then I might divulge a few Yankee plans to counter it.

Cost From $9,000 to $75,000

"People who are so cocksure about our determination to build 22,000 aeroplanes seem to be inspired with the notion that aeros are all made on the same pattern, turned out of the factory as alike as two cubes of sugar. As a matter of fact aeroplanes vary in cost between $9,000 and $75,000; and a comprehensive aerial programme must include everything from a simple school machine to a flying dreadnaught. New inventions are continually being tried out, new appliances and models must be installed in order to keep up with the times—or a little ahead of them.

"The German General Staff—that mysterious body working and thinking all the time somewhere between Berlin and Constantinople—isn't going to let things remain at a standstill over here, and we may be called upon to revise our whole system in order to wreck theirs. That is war, which, as I have explained, is the most elastic thing in the world.

"A recently cabled report quotes the German commander of aviation as saying that American aviators will fail, among other things, through lack of courage. That German obviously, has never encountered an American flyer in action."

Lectures to Aviation Students

Boston, Mass.—One of the local scientific men who is doing his bit for the country is Dr. Frank Waldo of Cambridge, who has volunteered a series of eighteen lectures on meteorology to the men at the Squantum aviation camp. Meteorology is one of the important matters about which aviators should be informed, and Dr. Waldo is one of the best men in the country in this line. Dr. Waldo was formerly a professor in the U. S. Signal Service at Washington, and an instructor of the training school at Fort Meyer. He is the author of the treatises on weather service that have been studied by the officials in the past twenty years.

Discuss Aircraft Spruce

A conference on aircraft spruce specifications of great importance to the successful accomplishment of the airplane programs of both the United States and the entente allies was held here recently. Those who took part included spokesmen for the Pacific coast and Carolina spruce interests, called to Washington particularly for the purpose, and representatives of the Aviation Section of the Signal Corps; the aircraft production board of the Council of National Defense; the British, French, and Italian missions now in this country; the lumber committee of the Council of National Defense; and various American airplane manufacturers.

Among the purposes of the conference were to make the spruce manufacturers thoroughly familiar with the quantity and character of the requirements which the nations fighting Germany will need during the coming year; to arrange for standard specifications for sawing the spruce for all four of the nations represented, eliminating the waste and confusion which now arises from improper sawing; and to discuss arrangements for a proper coordination of purchasing.

The representatives of the spruce manufacturers were Messrs. Howard E. Jayne, F. A. Douty, and Israel Ludlow, representing the Pacific coast interests, and C. J. Whitme representing North Carolina spruce men. Among others who were at the conference were C. B. Gordon, of the British munitions purchasing board; Maj. R. Perfetti, of the Italian mission; Capt. A. de la Grange and Capt. Henry Dourif, of the French mission; Messrs. Coffin, Deeds, Waldon, and Sligh, of the aircraft production board; Maj. Henry Souther and Maj. W. H. H. Hutton, of the Signal Corps; Dr. Henry Crampton, of the advisory commission; E. T. Allen, of the lumber committee of the Council of National Defense; Karl Zimmerschied, of the automotive Committee; and W. C. Chadeayne, of the Curtiss Aeroplane Co.; Glenn L. Martin, of the Wright-Martin Co.; F. H. Russell, of the Burgess Co.; and H. E. Talbot, jr., of the Dayton-Wright Co.

The New Factory of the Kyle Smith Aircraft Company, Wheeling, West Va.

South America Buying Aeroplanes Here

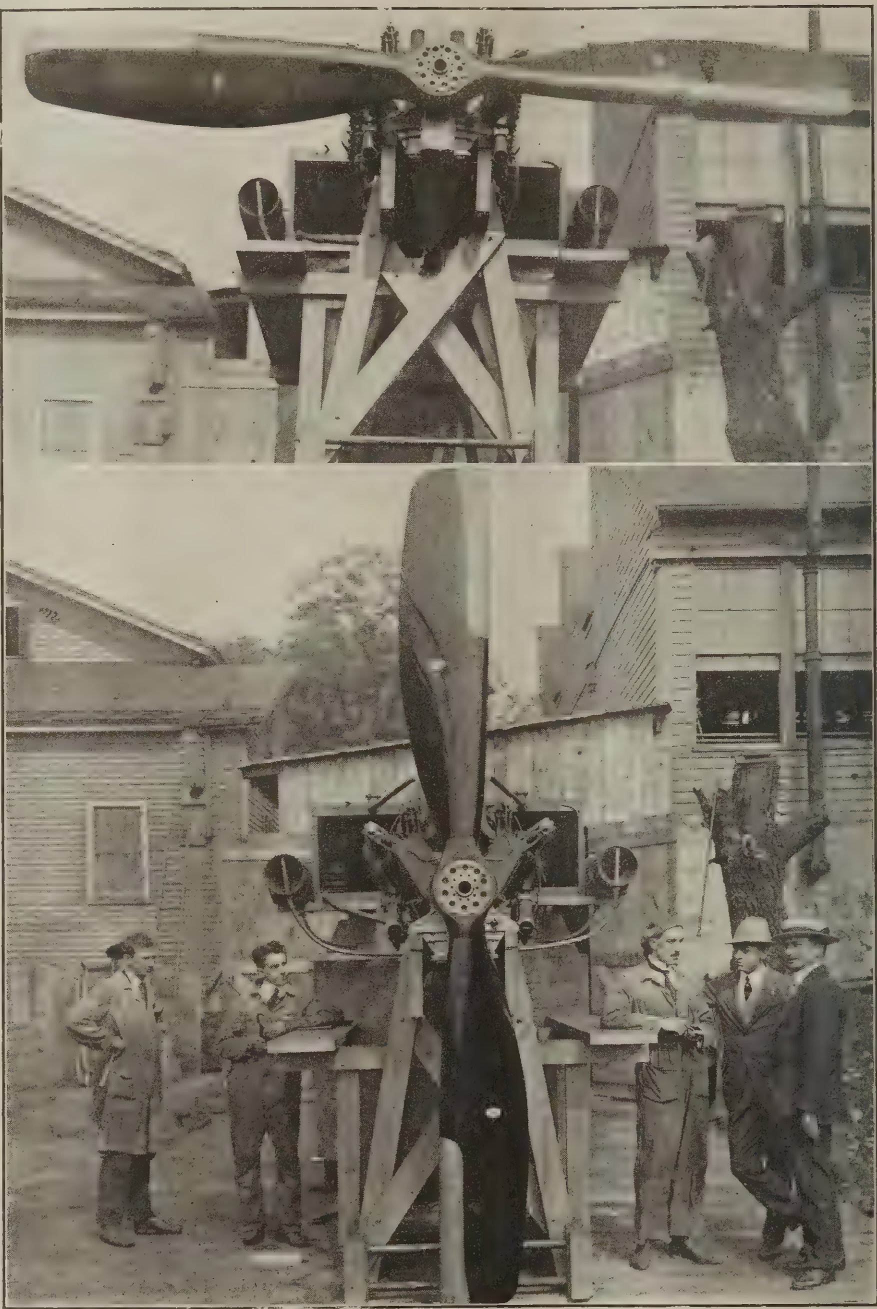
Led by Brazil, long the leader in aeronautics in South America, the various republics below the Panama Canal have adopted programs of aerial preparedness and are buying aeroplanes. Santos Dumont, a pioneer aviator and aeronaut, whose dirigible was the first to circle the Eiffel Tower in Paris, introduced aeronautics to his countrymen in Brazil, and for the last few years the leading sportsmen there have done much flying. Only recently the Brazilian Government, profiting by the war lessons of Europe, decided to establish flying schools and organize its aviation service. Reasons for coming here to buy aeroplanes were given by an inspector at the Plainfield, N. J. plant of the Standard Aero Corporation, which is building these South American machines.

"The Brazilian Government, which is probably the most progressive in South America," he said, "realizes that its defences are entirely inadequate without an efficient air service. Following the decision to organize its flying corps, came the question of getting aeroplanes. Officers of the Brazilian army had been acting as observers in Europe and knew exactly what types of machines were required for the work to be done.

"Armed with the knowledge these experts set out to get the machines. They considered the various typs of European aeroplanes and those made in the United States and finally decided that the later were best suited for South American use. After an inspection of the various plants and the machines manufactured here, they chose those made by the Standard Aero Corporation, which are fitted with the Hall-Scott motors. Now a number of these are being built and before the end of the summer will be in use in Brazil.

"One of the most efficient of the machines ordered and now being built is the Standard 'Model D,' which is a twin-motored military hydroaeroplane. This has two 120-horsepower motors and can make 80 miles an hour, which is very fast for a flying boat. In addition it can go as slow as 45 miles an hour, which allows of safe landing anywhere, even if the sea is rough. This machine can carry more than 1,300 pounds of dead weight, which will allow it to carry guns, bombs or torpedoes. There are accommodations for both pilot and observer, both of whom may handle guns, and the machine has a range of action of about 450 miles. Even when fully loaded, it can climb 3,400 feet in ten minutes, which is a splendid performance for a seaplane.

"In addition to this type, a number have been ordered for land flying alone. These, of course, are not so heavy and are particularly adapted to flying at high altitudes. These machines will probably be used for many purposes apart from their military services. Transportation is the great problem in Brazil and all the other South American countries and these machines wil make trips over the mountains in a few hours, where it would take days by the roads or trails. It is planned to use them for mail carrying and Santos Dumont has perfected palns for using aeroplanes as express carriers. With their ability to carry a large amount of dead weight, it is quite possible that they may be used to bring out bullion from the mines high up in the mountains. There are a number of other commercial uses to which they might be put, but of course, their most important service will be as part of the military and naval defence of Brazil."

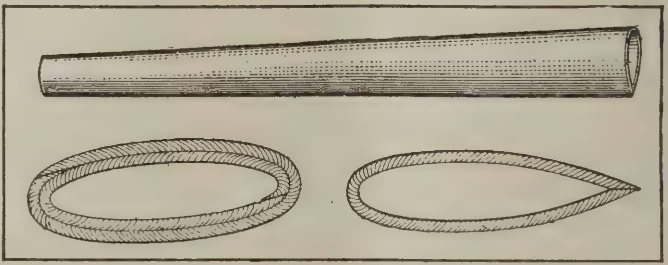


Two Views of the Sterling-Sunbeam Motor (described on page 719) on the Test Stand. In the Lower Picture are Shown, from Left to Right, Two Sterling Motor Experts; G. G. Goode, Chief Engineer; Capt. Lentz, U. S. A., and Mr. Criqui, President of the Sterling Co.

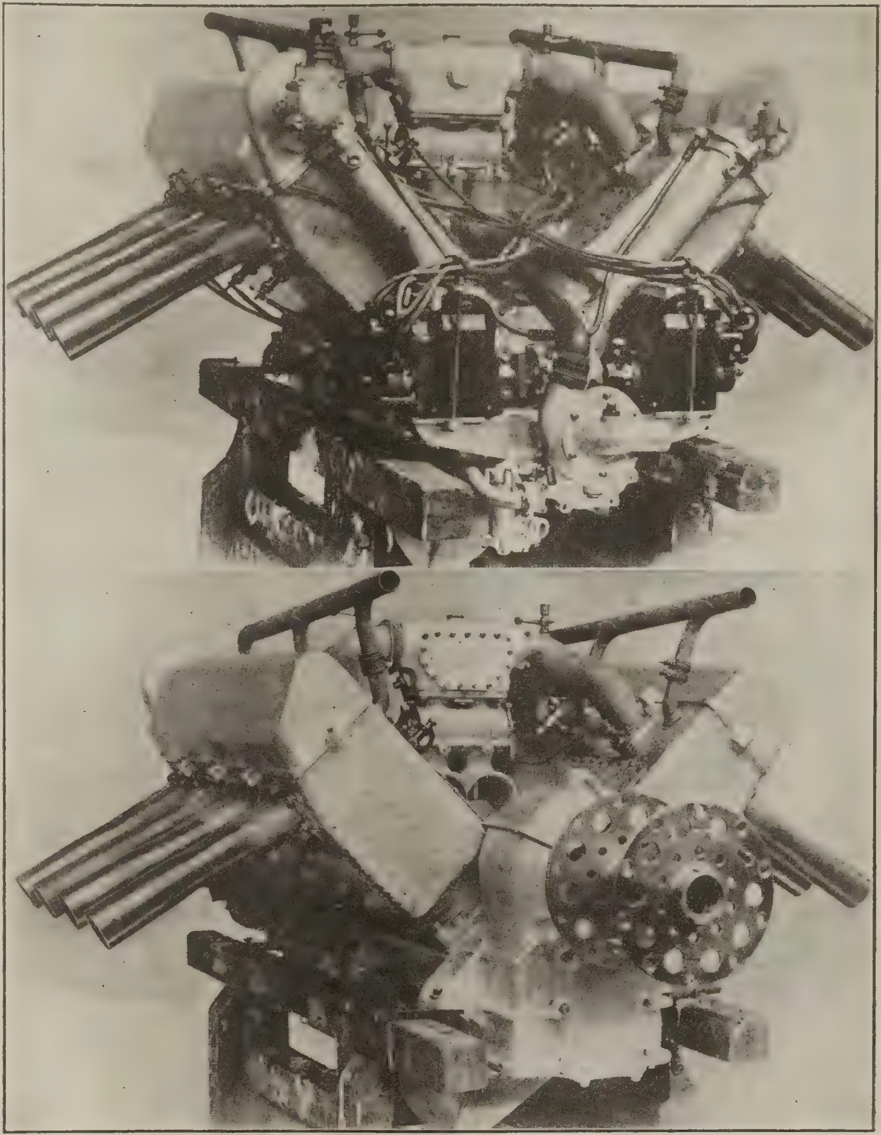
HOLLOW-WOOD SPAR AND STRUT CONSTRUCTION

It has long been realized by aeroplane designers that great advantages may attend the employment of hollow sections for various components of an aeroplane, such as struts and spars. With regard to the former the general practice is to make the strut of two halves, glued together along the major axis of the cross section, the two halves being spindled out to the desired extent, usually but not invariably leaving a web in the center to make the strut stiffer against bending stresses. In the case of spars, as that term is understood in the aviation world—*i. e.*, a beam subject mainly to a bending load—there are two methods in general use. One consists in spindling the spar, whose outside shape is as nearly rectangular as the wing section will permit, out to an I section, and the other consists in making what is usually termed a box spar, that is to say, an approximately rectangular hollow section, built up of two halves joined together with hardwood tongues and glue. Other forms of construction are in use, but not to so great an extent. That new methods will be developed appears probable, since there is always room for improvement no matter how serviceable a thing may be. Experiments have, we believe, been made from time to time with ply-wood construction, but as this method has not yet become general, it would appear that it presents some difficulty.

A system which, although resembling it to some extent, should not be confused with ply-wood construction is that specialized in by the McGruer Bentwood Hollow Spar Co., of Commercial Wharf, Lambeth, London, S. E. 1. This firm make a specialty of hollow masts, spars, booms, etc., for yachts and other craft, and their special process consists in bending flat boards of wood breadthwise and joining the edges in the form of a scarf joint with glue. One of our illustrations shows two forms of construction, the one an elliptical section made of two thicknesses of wood, and the other a stream-line section bent from one piece and glued along the trailing edge. If desired, struts, can be made on this principle, which taper from the centre to the ends. The wood fibres all lie parallel to the longitudinal axis of the strut, thus, it is claimed, eliminating knots and swirls. We understand that the firm have had samples tested at the R.A.F. for 12 hours in water at a temperature of 112 degrees F., and that they successfully stood the test. They have also had samples tested in cold water for 30 days without the form of the spars being affected and without twisting the glued joints.



THE STERLING-SUNBEAM-COATALEN 350 H.P. AIRCRAFT MOTOR



The Magneto and Propeller End of the 8 Cylinder 220 H. P. Sterling-Sunbeam Engine

THE Sterling Engine Company, of Buffalo, has acquired the sole rights from the Sunbeam-Coatalen Co., of Wolverhampton, England, for the manufacture of the famous Sunbeam aircraft engines. As the company is in constant communication with Mr. Louis Coatalen, it is kept informed of changes as they are being made. All parts of the Sterling-Sunbeam motor are made in the United States and are so accurately made as to be interchangeable with the motors built in England and used by the allies.

It has been learned from a reliable source that there are 16,000 of the 200 h.p. Sunbeam-Coatalen motors and 3,000 of the 350 h.p. motors in production in Great Britain. Another recent report has been received to the effect that a twin motored machine, with two 350 h.p. Sunbeam motors made a flight over the Alps from London to Rome.

In handling the aircraft motor the Sterling Company has the benefit of years of experience in producing high-speed marine motors. Records established by Sterling motored speed boats are interesting. The first eight-cylinder motor made in this contry was made by the Sterling Company. The Gold Challenge Cup was won for seven years by Sterling motors. In 1910 the "Courrier" won the first long distance race at Palm Beach, covering 119.18 statute miles at a speed averaging 26 m.p.h. In 1911 the "Mitt, 2d" won the Challenge cup at Alexandria Bay. The "P. D. Q." in 1912, the "Ankle Deep" in 1913, the "Baby Reliance" in 1914, "Miss Detroit" in 1915 and "Miss Minneapolis" in 1916 won the cup, covering 65.47 miles in an hour.

The Sterling company is now prepared to supply the 350 h.p. engine in any quantity. The 200 h.p. motor, eight-cylinders, weighs 475 pounds; the 350 h.p. motor, with twelve-cylinders, weighs 1,058 pounds, and this latter is described here in detail.

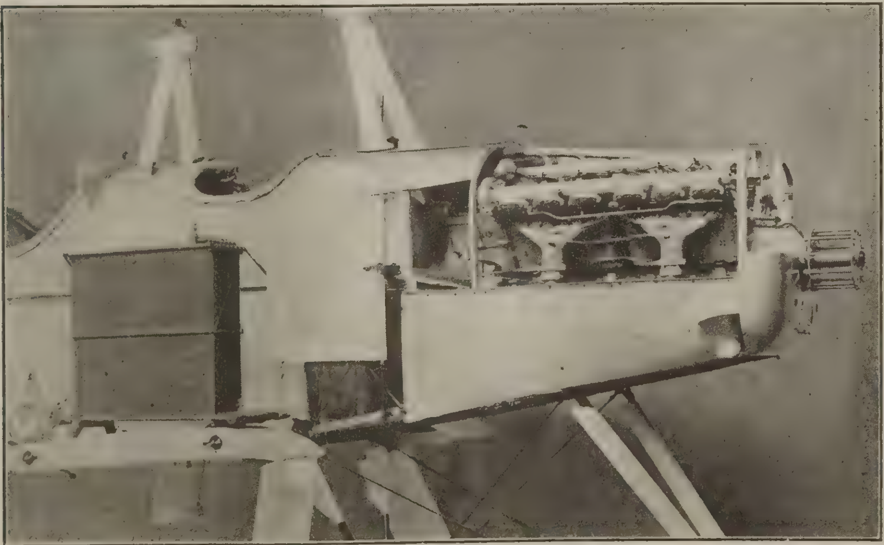
The bore is 110 m.m. and the stroke 160 m.m. The gear ratio is two to one. The actual delivery of horsepower is 300 at 1,700 r.p.m., 332 at 1,900, 360 at 2,100, and 365 h.p. at 2,200 r.p.m. At 365 h.p. the propeller revolves at 1,100 r.p.m.

As in the foreign-made Sunbeam motors, castor oil has been found the best lubricant. The consumption of oil is .04 pints per brake horsepower hour. Fuel consumption, .49 to .5 pounds per brake horsepower hour. The gasoline used is ordinary commercial gasoline, about .62 Buhme. The compression ratio at sea level is 6 to 1. Mean effective pressure 135 pounds, which is within 15 per cent. of the theoretical possible mean effective pressure.

The crankcase is of aluminum alloy. The upper portion carries the bearings complete with caps. The lower half merely acts as a collector for the oil. The upper half weighs 87 pounds and the lower half 17 pounds.

The crankshaft is drop forged and counter balanced. Crankpins are hollow, plugged at each end to serve as oil leads. Bearings are babbit lined. Roller bearings are used on the shaft and a single-roll ball bearings for the thrust. The crank, complete with timing gear, weighs 102 pounds.

There are four camshafts, each driven by a set of spur gears. The camshafts are machined from the solid and heat treated. They are hollow and oil is fed through small holes to the campush rods. Weight of each camshaft 4½ pounds. The camshaft gear weighs one pound.



The 12 Cylinder Sunbeam-Coatalen Engine Installed in a British Seaplane

Connecting rods are articulated, with the auxiliary rod leading. The steel is produced in the United States from a European formula.

Pistons are cast from a special alloy. The inner wall is braced by webbing and the casting face scraped. Four piston rings are provided, three at the upper end and one at the lower. Weight of each piston, complete with rings, 2 pounds 3 ounces.

Each camshaft is covered in by a cast aluminum housing, with removable inspection plates at each cylinder. Rocker fingers are interposed between cams and push rods.

Cylinders are of iron alloy, cast in blocks of three cylinders. Valve seats of cast iron and valves of Sunbeam-Coatalen special alloy. Each cylinder is provided with two intake and two exhaust valves.

Three oil pumps are located on the timing gear end of the motor; two are set in front of tanks, which receive the oil through a filter and force it to the various parts of the motor, and the third pumps oil from the sump and sends it to the oil cooling tank.

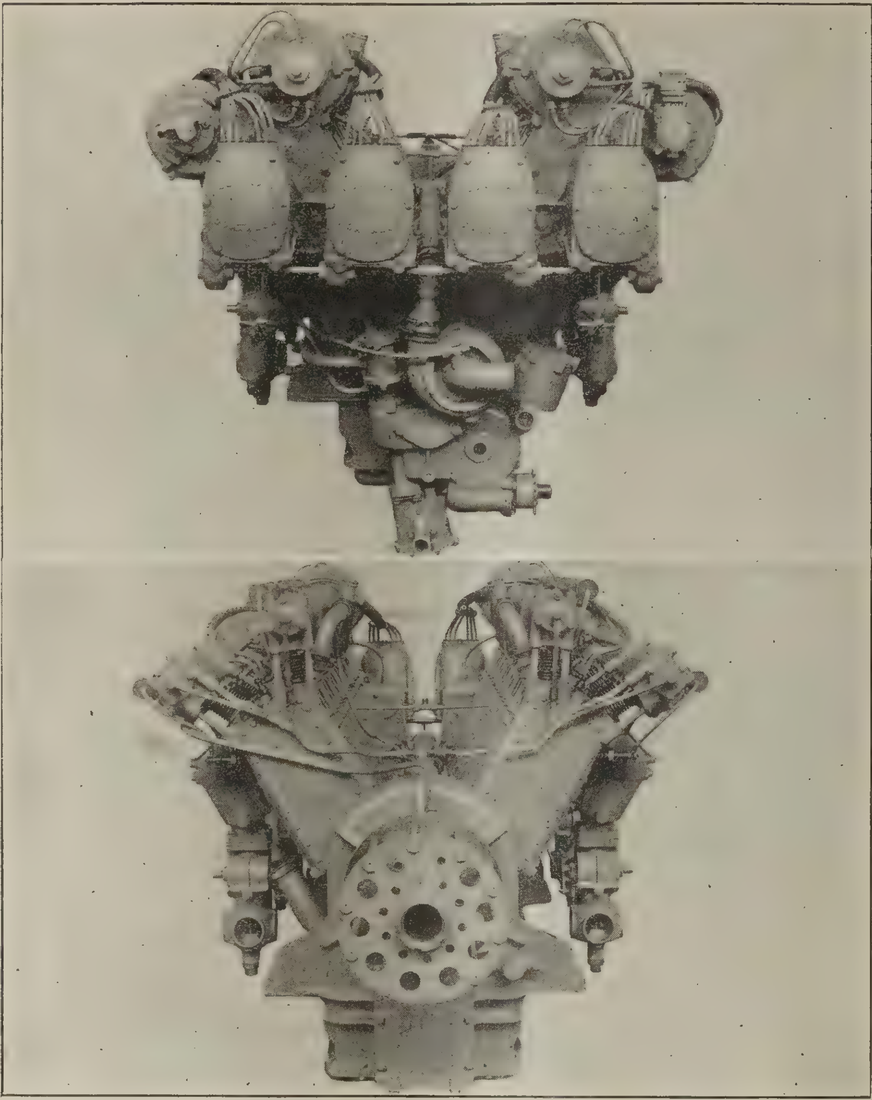
The circulating pump for the water is of aluminum. Its weight complete is 2½ pounds. The water enters the lower end of each bank of cylinders and emerges at the highest point. Provision is made for the employment of two flat vertical radiators to be located on either side of the aeroplane fuselage.

Ignition is by four high-tension magnetos, two for each bank of cylinders. Two "K. L. G." spark plugs for each cylinder. Up to the present this European plug is the only one which has stood up satisfactorily on the Sunbeam motor, but it is expected that a satisfactory American plug will be found. Each bank of three cylinders is served by a separate carbureter.

The propeller gear weighs 12 pounds and the reduction gear 6 pounds. The exhaust manifold weighs 10 pounds and the intake manifold 3½ pounds.

The propeller used in the tests at Buffalo was 12 feet 6 inches in diameter with an 8-foot 3-inch pitch. The propeller was made in England by the Sunbeam-Coatalen Co. and arrangements are being made to produce such propellers in this country. It is obvious that the best efficiency is obtained when motor manufacturers equip each motor with a propeller designed especially for it.

An unusually light, compact and effective air starter is provided for each set of six cylinders. This starter weighs only seven pounds complete with all valves and piping. The starters are built into the magneto end of the motor.



The Latest Twelve Cylinder 350 H. P. Sterling Sunbeam Aviation Engine Made in Buffalo

HERSCHELL-SPILLMAN DYNANOMETER

TO meet the demand for a satisfactory method of testing motors, the Herschell-Spillman Co. of North Tonawanda, N. Y., has designed and built the brake shown in the accompanying illustration.

This brake consists of a double rotating turbine, two stationary turbines enclosed in a water tight compartment, and four gates to shut off the water so that it cannot pass from the rotating turbines to the stationary turbines.

Their action is as follows:

The water enters the brake through holes in the stationary turbine blades which are formed in the heads of the watertight compartment. The brake is filled with water until it comes out of the overflow valve; then it is started up and the rotating turbine throws the water against the stationary turbine and it in turn returns it to the rotating turbine, thus causing the resistance. By opening the gates more water is allowed to pass back and forth, thus increasing the load and by closing the gates, the load is decreased. Enough water must pass through the brake to keep it cool for, of course, the work absorbed must pass off in the form of heat.

The brake is mounted upon roller bearings so that it moves freely and this is the only friction to prevent the outer casing from moving and is so slight as to be almost negligible.

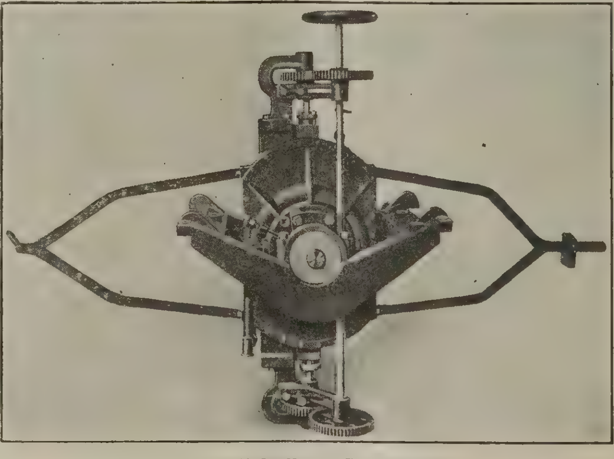
On one of the extending brackets or arms shown, a spring balance can be attached or any other convenient method of weighing the load. The other arm is provided so a weight can be attached equal to the weight of the scale.

The band-wheel shown, is for the movement of the gates and since both sets of gates must move an equal distance from the center in order to maintain the brake in a state of equilibrium, the arrangement of gearing shown attached to this handwheel is for the above purpose.

The dimensions of the brake are as follows:

Greatest distance over extending arms	8 ft. 2 in.
Greatest distance outside arms	27 in.
Length of shaft	27½ in.
Depth of case	18 in.
Height of case	27 in.
Distance across the supporting arms under lugs	29 in.
Distance center of shaft to arms under lugs	2⅞ in.
Length over all of supporting arms in direction of shaft	24 in.
Size of rotar	13 in.
Weight of brake	350 lbs.

The brake will take care of engines from the very smallest to a 5¾" x 6" six-cylinder engine.



The Herschell-Spillman Dynanometer

FIREPROOF VARNISH TESTED

Parker R. Bradley, a chemist associated with Weeks & Co., importers and exporters, 95 Liberty Street, New York, demonstrated the use of a varnish which renders fireproof the highly inflammable linen wings of aeroplanes, on the grounds of the Weeks Company at Newark, N. J., on July 22. Aeronautical experts who saw the tests pronounced them successful.

A flaming torch was applied to a standard aeroplane wing that had been treated with Bradley's preparation and later smeared with gasoline. The frame was enveloped in flames, but the blaze quickly subsided, leaving the wings and frame slightly charred but intact.

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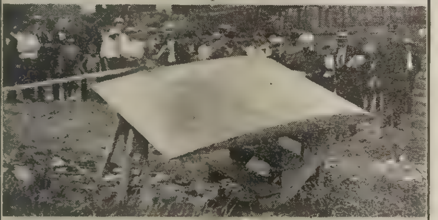
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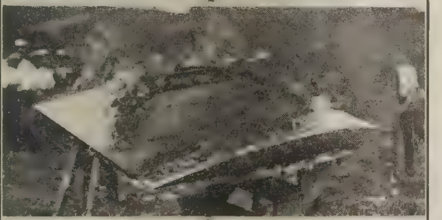
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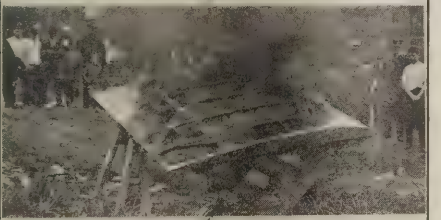
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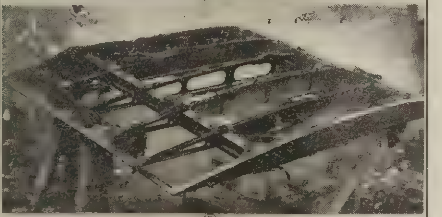
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An aeroplane wing treated with ordinary varnish now in use on aircraft in this country and abroad was subjected to the same test. It burned in a few minutes.

"Dope" is the technical or trade name for the liquid varnish-like material with which the linen covered wings of aeroplanes are painted to render them drum-tight, perfectly smooth and air-tight—to give them the necessary and utmost lifting and sustaining strength when the plane is flying in the air. There are several different brands manufactured in this country and a number in Europe, but all of them are inflammable.

The Weeks & Co. "Dope," not only meets all the present standard requirements, but has in addition the startling and unique feature of being absolutely fireproof.

The paint in case of fire acts exactly like the metal covering on wooden fire-doors. Intense heat may carbonize the wood, but fireproof paint will keep the support intact.

Rapid production of aeroplanes has heretofore been subject to the following drawbacks:

(a) The length of time it takes to apply each coat of dope to the plane surfaces. One *skilled* workman can apply a single coat to approximately 1,000 square feet of aeroplane surface per working day, which is equivalent to the total doped surfaces of an average size aeroplane. (b) The long time-lapses for drying between coats dependent entirely upon weather conditions and requiring at least 5 hours per coat for drying. (c) The great number of coats necessary—usually 6 to 10. (d) Labor difficulty and a lack of efficient production on account of suffocating fumes when dope is applied as at present by hand; even fatal results have occurred occasionally under present methods and the general tendency is sleepiness on the part of workmen inhaling the poisoned air.

On the other hand by a new machine method and process of treatment which Weeks & Co. have inaugurated the following offsetting advantages are obtained, viz: 1—One coat of the Dope can be applied to 1,000 square feet of plane surface in fifteen minutes by our special automatic machinery and be more evenly and perfectly distributed. This increased production tremendously reduces skilled labor and greatly decreases labor cost. 2—By the new process and the special composition of the dope each coat is dried in one hour owing to the even temperature and lack of humidity under which the work is carried on. 3—As each coat is dried so quickly it will be seen that under the new machine process from six to ten coats of dope requiring 15 minutes each to apply and one hour each to dry can be acomplished in a small fraction of the time now required. This great saving of time increases productiveness of a given factory space. 4—The new process does away entirely with dangerous suffocating fumes as all doping and drying is done automatically by special machinery in closed rooms, where workmen need enter but rarely, and then only when supplied with a protective apparatus. By holding these fumes captive, so to speak, they are prevented from permeating the whole plant and thus general efficiency is increased.

The illustrations of Series A show the stages in the ignition of a section of an ordinary aeroplane, doped and varnished in the usual way: 1, applying gasoline to the plane surface; 2, applying the torch; 3, eight seconds after ignition; 4, thirty seconds after ignition; 5, how the plane looked when the fire had burned out. The illustrations of Series B show the stages in the ignition of the wing section specially prepared with the new fireproof dope prepared by Weeks & Co.. 1, covering with gasoline; 2, applying the torch; 3, the gasoline burning on the surface of the wing; 4, the appearance of the wing after the fire, showing how slightly the fire affected the fabric; 5, some interested spectators of the test, including Capt. A. Vullierine, of the French Commission; Augustus Post, of the Aero Club, and W. R. Weeks.

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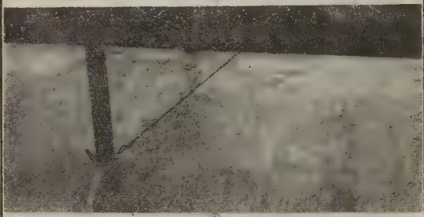
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The Call to the Air

(Editorial in N. Y. *Times*)

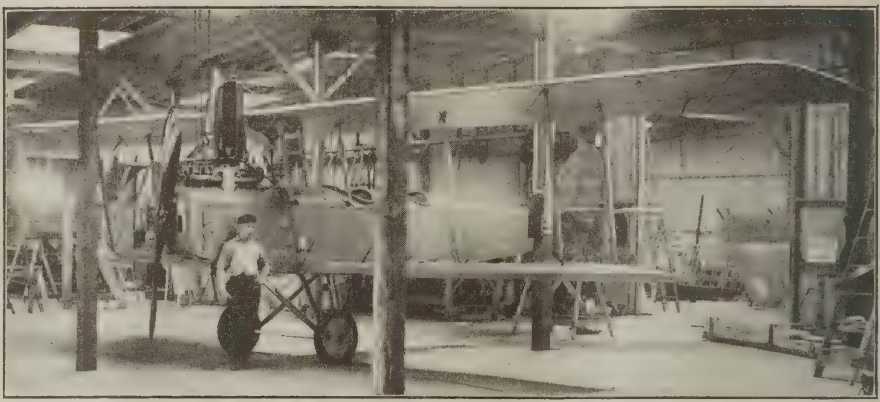
The War Department has done well to correct the false impression that the obstacles to the admission of recruits for aviation service were so formidable that unless he could get his training through one of the unofficial aeronautic agencies, and try for admission to the Lafayette Escadrille in France, a patriotic young man might better enter some other branch of the army and be done with it. Certainly, thousands of young men anxious to serve their coutnry as airmen have been led to believe that the chances of entering the United States Army in that capacity were few. It has been the general belief that the airmen were all commissioned officers and that no recruits from civil life would be admitted unless they had collee degrees. The official announcement that thousands of recruits are wanted for air service is therefore timely. Applicants may apply to the Signal Corps headquarters in Washington, to the officers in charge of the aviation fields at Mineola, L. I.; Essington, Penn.; San Antonio, Texas; San Diego, Cal.; Omaha, Neb., or to the Signal Officer of the Central Department of the army in Chicago. It would be wise to establish sub-stations for the examination of recruits in many other places.

The qualifications of a competent military airman must be exceptional. He must have a good mind as well as a sound body to master the theory of flight, the principles of engine construction, and military science as well. He must become an accurate and alert observer, and must learn all the details of signaling and the use of wireless telegraphy. But there is no likelihood that any of the applicants will be ignorant of the requirements of the job. They will all be men who have given some thought to aeroplaning, who have been students of aviation, even if they have had no machines of their own. Aviation has taken a strong hold on the young American imagination. While the work of examining recruits must be much harder than in any other military branch, and every man accepted must be precisely up to the mark, there is no doubt that there will be a host of volunteers from this time on, and that the needs of the service will soon be met.

THE STANDARD J-R PURSUIT AEROPLANE

IN general form the new J-R pursuit aeroplane which has just been delivered to the government, is similar to the well known "Model J" preliminary military training tractor. The 90 H.P. motor has been replaced by a special Hall-Scott 175 H.P. motor, and the R.A.F. 3 wing-curve has been superseded by the U. S. A. 6 curve.

Throughout the entire machine, the weight has been kept down within judicious limits, and neither strength nor air-worthiness has been impaired. The production of this fast machine has been made possible by the fact that much experimentation was made in the slower J tractor, and principles which were conducive to speed were brought out by a careful evolution of the training tractor in preference to a new and untried design.



Three-quarter front view of the Standard J-R. Note the mounting of the radiator and the new exhaust leader extending above top wing.

General Dimensions.

Wing span, upper plane	42'-10"
Wing span, lower plane	31'- 0"
Wing chord, both planes	6'- 0"
Gap betwen planes	5'-11"
Overall length of machine	27'- 2"
Overall height of machine	10'-10"
Net weight, empty	1764 lbs.
Gross weight, loaded	2400 lbs.
Speed range, full load	95-48 m.p.h.
Climb in 10 minutes	5,000 feet
Gliding angle	1 to 11
Motor, (Hall-Scott A-5A special)	175 H.P.

Planes

Planes are set at an incidence angle of 2½ degrees. Dihedral angle, 3%; sweepback 5 degrees; stagger 10 degrees or 12 inches.

The upper plane has an area of 258 sq. ft. and the lower plane 159 sq. ft.; a total supporting surface of 417 sq. ft. including the ailerons. Ailerons are 2'-2" wide and 9'-10" long, with an area of 21 sq. ft. each.

The maximum load per square foot of supporting surface is 5.75 lbs.

Wing struts are provided with ball-and-socket fittings which give an even bearing at any angle of the struts.

The wing panel over the fuselage is 30" wide. A space of 1½" is left between this panel and top wing sections, and also between the fuselage and lower wing sections. Each of the upper main sections is 20'-3" in length. Each lower wing section is 14'-2" in length.

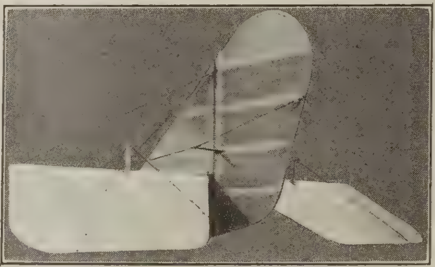
Fuselage.

The fuselage is 23'-6" in length, not including the rounded nose, at the forward end, which is detachable. The nose piece adds 9" to the length of the fuselage.

Maximum width, where planes are attached, 30"; maximum depth, over the cowling at the observer's or forward cockpit, 3'-4".

The upper longerons are horizontal to the line of flight, and the lower longerons are bowed in a continuous curve from the nose plate to the tail. Metal cowling is employed for covering in the motor, and for the forming of the curved top as far back as the rear of pilot's seat. From the pilot's seat to the entering edge of the tail plane, the top is formed with light strips of spruce mortised into formers carried on the upper longerons.

Single control of the Deperdussin type is installed in the rear cockpit.



Tail group of the Standard J-R

Tail Group.

The stabilizer or tail plane is horizontal to the line of flight. It is 3'-1" wide and at the trailing edge measures 10' across. Area, 23.7 sq. ft. It is supported by a pair of bracing wires above and below at either side of the fuselage; they are indicated on the drawing.

The elevators or tail flaps are 2'-6" wide. From tip to tip they measure 11'-3" across. Each flap has an area of 11 sq. ft.

The vertical fin, triangular in shape, has an area of 3.7 sq. ft. It reaches a maximum height of 2'-9" above the tail plane.

The rudder is 2'-8" wide and 4'-10" in height; area 10 sq. ft.

Landing Gear.

The two-wheeled steel landing gear combines lightness with strength and is streamlined throughout so as to offer a minimum of head resistance. On landing the axle rises in vertical guides and when normal it rests in U shaped steel cases streamlined with aluminum.

Wheels are 26" by 4". The tread between wheels is 68¾".

The tail skid is simple in construction and swivels in a free manner which makes maneuvering on the ground an easy matter in restricted and rough landing places.

Motor Group.

The engine bed is especially rigid, being braced by means of steel tube stays which connect the ash engine supports to the longerons. The motor is a Hall-Scott A-5A, 6 cylinders vertical, four-stroke cycle, with a bore and stroke of 5¼" x 7", and developing 175 H.P. at 1400 r. p. m. Weight, 605 lbs. Fuel consumption per hour, 14 gallons. Oil capacity in crankcase, 4 gallons.

Fuel tank capacity, 51 gallons; gravity tank capacity, 7¾ gallons: total tank capacity, 58¾ gallons.

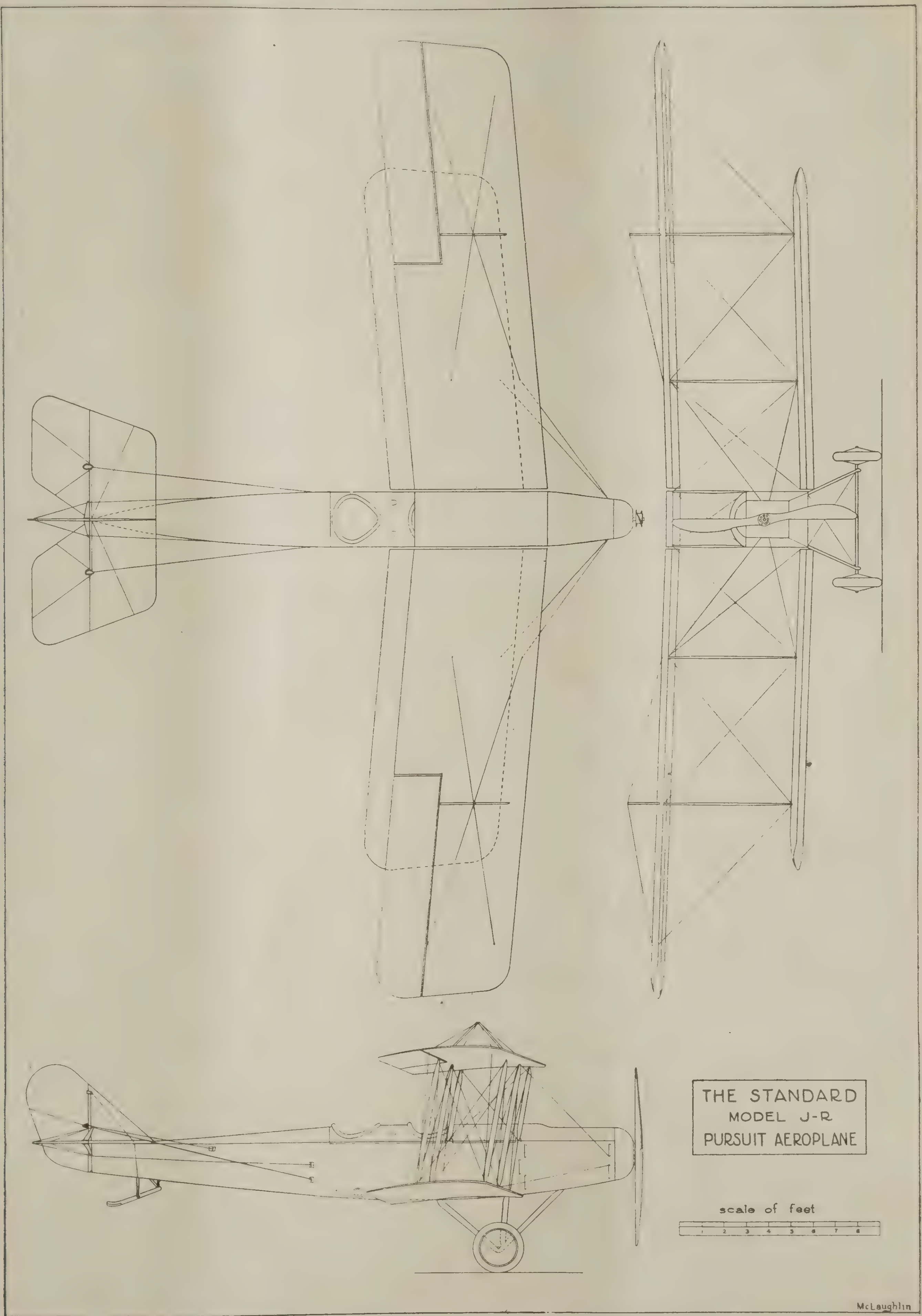
An auxiliary fan-driven gear pump projects from the fuselage, which pumps fuel from the main tank to the gravity tank.

The radiator is mounted over the motor, braced from the upper plane, and is free from vibration.

The propeller is of "Standard" design and manufacture. The material is black walnut. Diameter, 8'-4"; pitch 5'-6". Viewed from the pilot's seat the direction of rotation is clockwise.

The maximum load per H.P. is 13.7 pounds.

Looking down on the Standard J-R, showing the wide observation range.



THE STANDARD
MODEL J-R
PURSUIT AEROPLANE

AIRCRAFT AND MOTOR CAR ENGINE DESIGN

Contrasted From the Standpoint of a Designer and Manufacturer of Both Types

By LOUIS COATALEN

Influence of Service Experience in Modifying Design

A particular effect of the war on the evolution of aviation is the rapidity of the advance which has been and which continues to be made in the design and production both of aircraft and of engines for them. Compared with the average of enterprise in normal times, the amount of experiment that has been carried out in these directions during the last year or two is amazing, and the practical results obtained are correspondingly important.

In the author's factory experimental work is held to be of vital importance, in that the discovery of anything that gives advantage over any feature of previous practice is essential for the improvement of the product standardized. Doubtless, this accounts for the rapidity with which changes are made in details of design, also for the fact that the whole question of design is vastly more in a state of flux than the lay mind imagines.

Further, the experience gained by our aviators since the beginning of the war, together with the demand for the engineer to meet their ever-growing needs, have called for continuous evolution in the design of aircraft, all of which has inspired corresponding enterprise in regard to engine construction and production.

The Problem of Weight

With regard to the question of weight, the purpose for which the particular aircraft is required is of prime importance. Obviously, in the case of the engine in a machine designed for short flights only, the consumption of fuel and of lubricant is of less importance than the weight of the engine itself, whereas in the case of the heavier sorts of aircraft with which flights of long duration are obtained and for which great power per engine is needed, the consumption assumes much more importance than the actual weight of the engine.

In these latter cases efficiency as regards the weight of the power unit has to be arrived at by taking the weight of the engine complete with the amount of fuel and oil that would be consumed in the course of a flight of, say, five or six hours' duration. Thus for short flights the rotary type of engine generally and the air-cooled varieties are apt to show up to advantage, though in them consumption may be comparatively high, because this is offset by the relative lightness of their starting weight.

From several papers that have been read recently with reference to aircraft engines it is evident that, speaking broadly, as regards weight per horsepower, progress in the design of the ordinary water-cooled type is very marked. To the author's own knowledge, in the brief period of two years there has been obtained with this type a reduction in weight from 4.3 lbs. per horsepower to 2.16 lbs. per horsepower.

It follows that in designing aircraft engines a variety of points have to be considered with extreme care concerning which the builder of an engine for ordinary car service is not forced to take much trouble. This difference is rendered necessary, firstly, by reason of the amount of material employed, and secondly, on account of the comparatively light weight of the aircraft engine complete.

Valve Design: The Intermediate Stage

The design of the engine head, the cylinders, the valves, and the valve gear is one of the cardinal features of successful aircraft engine production. Car engine design allows of the employment of the L-shaped head, or, in some cases, even of the T-shaped type, though the latter is not used to any great extent today for automobile vehicle practice. Undoubtedly the L-shaped head has given excellent results in aircraft engine practice in the past, but the author prefers to consider that such examples really represent an intermediate stage in evolution and that they stand rather for modified or adapted car engine design than for aircraft engine design proper.

In point of fact, high efficiency is got with this type of head only by the use of a special design of valve cap that makes provision for the maximum surface of the engine head being served with water by the cooling system. In other words, you employ a form of duplicated valve cap, the removal of the upper and outer member of which reveals a space for water to circulate beneath it when the engine is working. At the bottom of that water is the valve cap proper. Further, to get the best results, it is needful to machine as much of the surface of this transition type of engine as possible.

The Number of Valves Per Cylinder

For standard car work one exhaust and one inlet valve per cylinder have sufficed for general practice to date, whereas present-day demands on aircraft engine designers are so great that any attempt to attain the requisite degree of efficiency by further exploiting such a scheme of design would lead inevitably to failure.

The necessity for running aircraft engines for long spells at either the maximum or a very high output without impairing the efficiency of the machine by distortion or putting the valves which assuredly would occur with the ordinary design employed for car service, and so forth, has compelled the devotion of much thought and a wealth of experiment to the problem, as a result of which it appears to be accepted as established that the multiple valve system is a necessity.

In this connection, to achieve maximum output, the author favors two exhaust valves per cyinder and two inlets.

The horsepower obtained by engines designed on this principle and now standardized would appear to justify this conclusion. For example, a six cylinder engine embodying this feature of valve design and having a cylinder bore of 81½ mm. with a piston travel of 156 mm., develops 135 h.p. at 3,000 crankshaft revolutions a minute. That is equivalent to a mean effective pressure of 134 lbs. per square inch. At 2,000 crankshaft revolutions a minute it represents a duty of 21 h.p. per litre capacity.

Among the advantages of the four valves per cylinder scheme are that a good shape of engine head is obtainable with it as well as the best sparking plug position, because that is in the center of the head in a vertical position. The inclination of the valves necessary for putting them into place allows of ample waterjacket space being provided round each valve and at the base of the sparking plug.

Three Practicable, More Than Four Undesirable

Judged by achievement to date, any other combination of valves per cylinder will not give quite the same degree of efficiency. Take such variants as three valves per cylinder on the principle of two exhaust and one inlet valve. While giving perhaps a better-shaped, because circular, head that can be machined practically all over, this combination practically precludes any other sparking plug position than in the side of the barrel. For obvious reasons, such an arrangement has many disadvantages. Nevertheless, three valves per cylinder scheme gives quite notably good results when exploited in certain ways and for certain special purposes.

This may be judged from the fact that the diameter of the inlet valve can be made large enough today to give about —— h.p. per litre capacity at 2,000 crankshaft revoultions a minute without involving serious trouble, such as would arise from heat effects, and so forth.

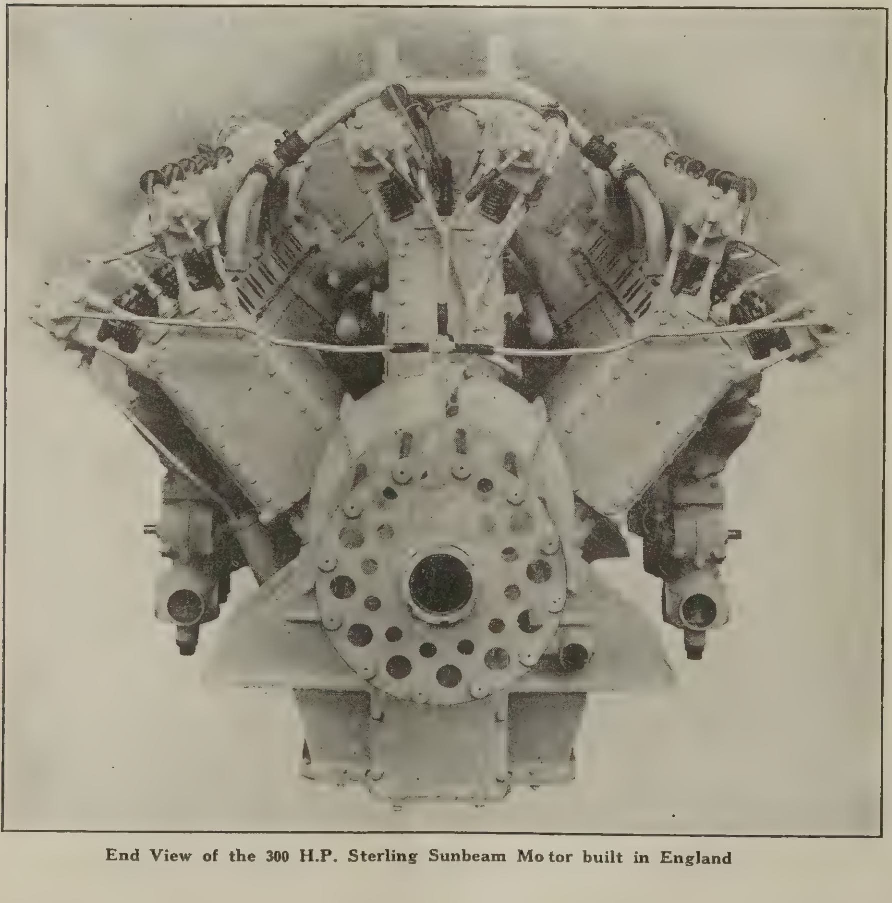
The use of more than four valves per cylinder is undesirable. It seems hardly possible to place them efficiently, leaving an even jacket all round each valve, without the employment of very complicated gear. We have an example of this in the Maybach engine, which has three exhaust and two inlet valves per cylinder. In this scheme little water space is provided between the valve seats, while the sparking plug is, besides, set horizontally in the side of the cylinder barrel.

Undoubtedly in any type of engine it is a gain when the surface of cylinder head can be machined. This is not possible, however, with the four valves per cylinder design. Hence in that case a compromise is achieved by making the surface as small as possible and by finishing it as much as possible by hand with files, scrapers, and so on.

The Matter of Material

In regard to the material of which the cylinders are fashioned, a tribute is due to the metallurgists and manufacturers on account of the great improvement in the cast iron available for cylinders of recent years, the very high tensile and good ductivity qualities of it being particularly notable.

Of course, the advent of aluminium alloy as a material for cylinder castings marks an im-



End View of the 300 H.P. Sterling Sunbeam Motor built in England portant stage in the advance of aircraft engine design and production, the rate of progress obtainable by the designer being determined primarily and always by the materials that are available to him. A series of experiments carried out by the author over a period of more than twelve months has proved the superiority of aluminium alloy for this work. It has established the fact that it can give completely satisfactory results when the precisely right alloy is handled with knowledge and is employed on tested designs. Thus a 12-cylinder aircraft engine of 92 mm, bore and 135 mm. poston travel has run at full power for 100 hours without an involuntary stop or untoward incident, otherwise with complete satisfaction.

With that sort of confidence which is founded on reason, as the result of cumulative experience on the one hand and further research on the other, particularly with a view to rendering these special alloys capable of being cast easily in the factory, we may look for both speedy and consistent improvement in those varieties that will be available for this highly specialized work. Though we are merely on the threshold of realizing the possibilities of aluminium alloys for cylinder castings, it cannot be doubted that within a brief period they will be recognized as the standard materials for this work, cast iron being discarded in favor of them.

Progress in Castings and Alloys

The importance of the matter is realized by the aluminium founders of the country. It is encouraging to note the relatively great amount of enterprise being displayed by them in this connection. At the present time the more important aspects of the case embrace the effect of heat on the strength of the given alloy as well as the coefficient of expansion of it.

In the manufacture of aircraft engines more and more use is being made of aluminium alloys of varied analyses, each to suit some particular condition of work. With a continuance of advance in knowledge of heat treatment, and so forth, there is no gainsaying that this material will be employed for aircraft engine construction to a greater and yet more great extent.

Aluminum Alloy Pistons

Under this head it falls to be observed that for about two years the author has standardized aluminium alloy pistons with excellent results. Even when they have been made with a green sand core no trouble can be said to have been experienced with them.

A point to note, however, is that the greater clearance needed when the aluminum alloy piston is cold represents a disadvantage in comparison with cast iron pistons, and one which has not yet been overcome.

Special Alloys in Place of Gunmetal for Oil Pump

Another special alloy is being used in place of gunmetal for the construction of the oil pump employed for the forced feed lubricating system. These details are of the gear-wheel type. As regards both strength and bearing qualities the alloy employed has proved to the full as satisfactory as the gunmetal used formerly.

Problems Presented by New Materials

Before quitting the subject of materials in general, at this juncture it will be convenient to pass the general situation in rapid review. Manufacturers have been called on to make immense efforts in the matter of supplying a wide variety of materials for multi-cylinder aircraft engines. They have met and mastered right ably the usual sequence of difficulties that materialize whenever man attempts to break fresh ground.

In particular, the high tensile steel stamping now being supplied, for instance, for a six-throw crankshaft for a 500-h.p. aircraft engine, and so forth, is a splendid example of the steelmakers' craft today. There would have been no call for it had not the advent of war made it necessary on a sudden for us to standardize in these islands aircraft engines of high output.

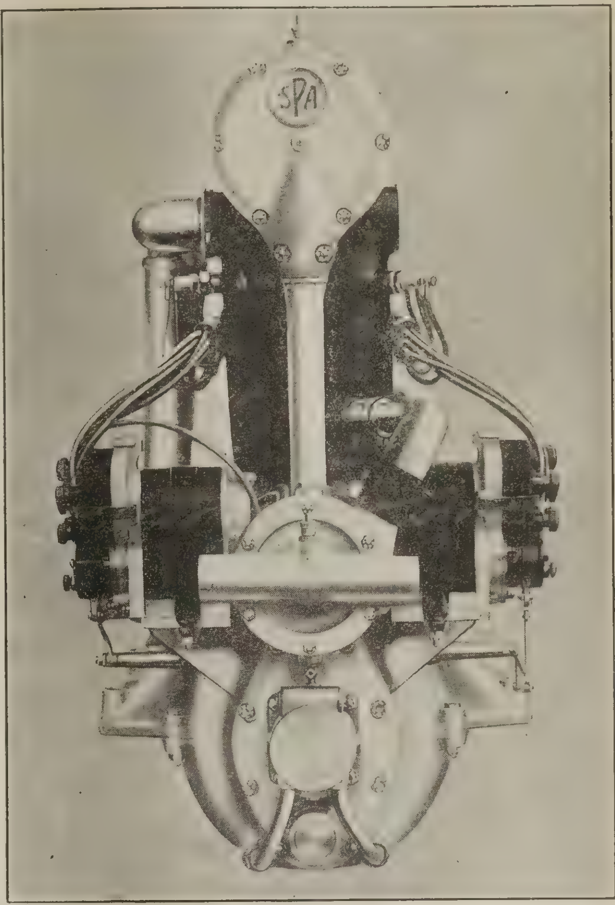
Of course, the necessity for using unprecedentedly high-class materials for these constructions has presented alike metal makers and alloy producers, as well as the engine makers' machine shops, with a series of fresh problems which have had to be overcome detail by detail before it has been possible to obtain that degree of success which is necessary ere any given product can be regarded as a practical proposition.

Briefly, there has had to be an all-round improvement in method; more scientific control has had to be exercised and procedure elaborated; while, of course, the last link with rule of thumb method has been broken in our factories by coming of the standardized aircraft engine of proportionately great power output per unit.

Obviously, there has been a call for devoting the greatest attention to detail, since it will not suffice merely to employ more expensive workmanship and higher grade materials. In regard both to design and to procedure, each part must be accorded, besides, greater attention to detail than any that has sufficed for car engine and production to date. In what direction this extra study is needed is discovered, of course, by the laborious process of experiment.

After the knowledge has been attained, when it comes to standardizing practice in the shops, very special attention has to be given to avoid points likely to start flaws. At this stage these are a prolific source of trouble in the production of aircraft engines. Each man has to be trained to give the correct proportion of attention to the various details of his job; therefore a more highly skilled class of labor is needed.

Your individual worker must know precisely what function his particular task and the part which he is engaged in fashioning plays in the scheme of the complete and, necessarily, at present somewhat complicated aircraft engine. Though only a matter of lightening, such details as boring parts, with which the car engine builder is not concerned, have to receive more than ordinary intelligent and conscientious attention during manufacture.


The 200 H. P. S.P.A. Aero Engine, One of the Most Efficient Italian Products

Connecting Rod Forms

Of course, both the radial and the V-type aircraft engine have introduced problems of design, the solution of which does not appear to be unanimous yet. In these varieties of engine design you have more than one piston attached to one crankpin. The diversity of opinion concerns the means by which this is done. Naturally, the design of eight- and of 12-cylinder standard engines for car service, such as our American friends are producing in large quantities, does not call for the same amount of care in this regard that is essential in the case of the more heavily loaded aircraft engine.

The original form was that in which the end of the subsidiary connecting rod is mounted on the outside of the main connecting rod. This, however, makes relatively a very heavy big end not suitable for engines from which is demanded the high duty necessary for aircraft service, as the wear of the big end is controlled by its weight and oil pressure.

A lighter construction is achieved by the link-rod method, wherein the subsidiary member is attached to the main one by a pin placed so near the center of the crankpin as possible. This arrangement has the additional advantage of rendering it considerably simpler to take up any wear in the big end bearings. For obvious reasons, in the former type that operation is not a very easy one.

The latter type, however, introduces a further problem. Owing to the centers of the bottom pins of the subsidiary rods not being coincident with the centers of the main pins, the movement of them is along an elliptical path in contradistinction to that of the crankpin, which, of course, is circular. The ellipse has the effect of altering thes troke of the piston attached to the subsidiary rod. The extent of the variation depends on the angular position of this pin with the center line of the main connecting rod, the distance from the main pin to the rod pin remaining constant.

The Lesser of Two Evils

It will be readily appreciated that the length of the piston travel can be corrected by tilting the axis of the ellipse in such a manner as to give the precise stroke desired. Owing to its change of velocity, also to its greater stress on the main rod due to the reversal of that rod during the firing stroke, this would have the further effect of altering the acceleration of the piston attached to the link rod. In going into this question the author came to the conclusion that the alteration of the stroke was the lesser of two evils.

The design adopted in certain radial engines, in which gearwheels are used to maintain the correct position of the link-rod pin, is a very clever method of overcoming these difficulties. Nevertheless, it makes for relatively heavy construction and tends to provide a further cause of mechanical failure.

In the case of the three-row 18-cylinder —— horsepower Sunbeam-Coatalen aircraft engine, the design of connecting rod arrangement in regard to the link pin details is such that the center row of pistons that are attached to the main rod of each series have a travel of 160 mm., while each of the pistons of the two side rows of cylinders has a stroke of 168 mm.

As it is essential to employ as light a connecting rod arrangement as possible, the question of loads on the bearings becomes of great importance.

Despite the fact that one engine of great power has been designed with balance weights, and has certainly given satisfactory results as standardized, and that, of course, these can be used in car practice, nevertheless, such accessories are practically precluded in the case of the latter-day aircraft engine on consideration of the weight per horsepower of the given engine.

(To be Concluded)

STEELS USED IN AERO WORK

By DR. W. H. HATFIELD, Brown-Firth Research Laboratory, Sheffield, Eng.

(*Continued from page 641*)

Approximate Mechanical Properties of Typical Steels Used in Aero Work

Steel Treatment	Y.P.	M.S.	E%	R/A%	(Izod)	Remarks
(1) Case-hardening steel—						
Carbon as supplied	20.0	30.0	30.0	65.0	..	
Case-hardened core	24.0	35.0	25.0	60.0	..	
Nickel as supplied	28.0	36.0	35.0	65.0	..	
Case-hardened core	35.0	50.0	25.0	55.0	..	
(2) Carbon steel—						
Forged or rolled	25.0	42.0	22.0	40.0	..	
Normalized	23.0	40.0	27.0	50.0	..	
(3) High-tensile—						
Hardened and tempered	55.0	65.0	20.0	55.0	35	
(4) Air-hardening Ni-Cr.—						
Air-hardened	90.0	100.0	10.0	35.0	20	
Oil-hardened and tempered	50.0	55.0	22.0	55.0	50	
(5) Stainless—						
Oil-hardened and tempered	40.0	50.0	20.0	55.0	55	Rustless.
(6) 25% Nickel—						
Toughened (quenched)	15.0	40.0	45.0	50.0	..	Non-magnetic.
(7) Manganese sheet steel—						
Toughened	19.0	35.0	Bend double		..	“
(8) Sheet steel—						
High-tensile (annealed)	20.0	30.0	“		..	
Oil-hardened and tempered	35.0	48.0	“		..	
Low-tensile (heat-treated)	20.0	30.0			..	
(9) Cast iron—						
Pearlitic	....	16.0	....	....	..	
Ferritic	....	12.0	....	....	..	

Carbon Steels—Carbon steels are of general interest because they constitute the major portion of steel produced and also, incidentally, because they afford a means of comparing the alloy steels. Plain carbon steel—and by that term we mean a steel to which nickel, chromium, vanadium, tungsten, etc., have not been intentionally added—is used, to take a particular case, for the production of aero-cylinders. Such steel is generally fairly high in carbon, and will give, approximately, a tensile strength of 40/50 tons with an elongation of 17-20 per cent. It has from time to time been questioned whether cylinder forgings require normalizing, and in my opinion I would say that it is strongly advisable to put them through this treatment to *dissipate* any stresses left from the forging or punching operation. If the finishing temperature be a suitable one, this precaution may not be necessary, but it is perhaps best as a safeguard. As illustrating generally the properties of carbon steel, one cannot do better than include the series of tests given before the Iron and Steel Institute some few years ago.‡‡ In the following table will be found the tensile test figures obtained from steels (made in this instance by the Acid Bessemer Process) varying from 0.1 to 0.86 per cent of carbon, whilst the manganese varies somewhat between 0.5 and 1.0 per cent. The figures (tensile test-bars 0.564 in. × 2 in., heat treatment on 1-in. bars) are given for the forged and normalized condition, since such steels are not submitted to the same treatment as alloy steels:

As Received (Rolled)

Mark	Analysis: Carbon %	Analysis: Manganese %	Yield-Point Tons per sq. in.	Maximum Stress Tons per sq. in.	Elongation % on 2 in.	Reduction of Area %	Y.P.×100 / M.S.
A	0.10	0.56	19.1	25.9	37.1	63.4	73.7
B	0.27	0.68	26.7	35.8	32.7	58.9	74.6
C	0.29	0.92	26.6	40.9	25.0	46.8	65.0
D	0.32	0.67	27.1	39.9	26.6	47.8	68.0
E	0.44	0.90	30.7	46.6	25.7	48.2	65.9
F	0.50	0.92	30.6	52.2	19.8	42.3	58.6
G	0.70	0.90	34.7	59.0	17.9	34.6	58.8
H	0.75	0.92	36.6	64.2	15.3	30.6	57.0
I	0.86	1.03	40.6	52.6	1.8	3.3	77.2
NORMALIZED							
A	0.10	0.56	18.5	24.8	37.4	59.8	74.6
B	0.27	0.68	25.0	34.3	30.5	51.2	73.0
C	0.29	0.92	25.7	40.8	26.3	53.5	63.0
D	0.32	0.67	25.5	39.3	24.0	44.4	65.0
E	0.44	0.90	28.4	48.1	21.0	41.8	59.0
F	0.50	0.92	30.6	52.3	18.8	38.2	58.5
G	0.70	0.90	35.7	59.4	15.9	29.0	60.1
H	0.75	0.92	35.9	65.4	10.8	17.1	54.9
I	0.86	1.03	39.0	54.5	1.8	2.9	71.6

It might be useful here to discuss the changes which take place in carbon steels on heating and cooling, and as illustrating the general changes I propose, although carbon steels have already been partly discussed from other standpoints, to take two particular steels—viz., a 0.25 per cent carbon as representing an ordinary structural steel, and a 0.60 per cent carbon as representing the steels used for purposes with which you are familiar. To study a steel of 0.25 per cent composition, we can advantageously draw a line on the Iron-Carbide Equilibrium Diagram, Fig. 1, in the position S-T. Starting from the liquid condition of the steel, we shall find that freezing commences at a temperature of a little under 1,500° C., followed by complete solidification at the line A-D. The mass then exists as a solid solution down to practically 800° C., at which temperature pure iron crystals begin to separate, and continue so to do until the line L-I is reached. Above 800° C. we have the mass consisting entirely of solid solution of carbide of iron in iron. Below that temperature the iron crystals gradually increase in size and number with falling temperature, the solid solution areas becoming richer in carbon owing to their loss of iron, until at the line L-I the mass consists of less than a third of solid solution containing 0.89 per cent of carbon distributed through a matrix of ferrite. On passing through the critical point marked by the line L-I, these remaining solid solution areas break down and become areas of pearlite. The line K-G is usually placed in the diagram, and represents an evolution of heat which is known to synchronize with the appearance of the magnetic properties of iron; it will thus be appreciated that when the steel passes through the temperature of 770-760° C., the ferrite, already precipitated, becomes magnetic. It is also to be noted that this only applies to the precipitated iron, as the iron of the solid solution retains its non-magnetic condition down to the recalescence point line L-I, which marks the change to pearlite in these areas.

To take a 0.60 per cent carbon steel and study it by means of a line U-V drawn across the diagram, we find considerable modification in the temperatures at which the critical changes take place. The initial freezing temperature begins a little lower and is followed by complete solidification on reaching the line A-D. The whole mass, consisting then of solid solution, cools down as a homogeneous substance to just over 730° C., at which temperature some little iron separates from the solution. Within 20-30°, however, the mass of the steel still consisting of solid solution breaks down into pearlite, and the result is that we have a steel now consisting of pearlite, in which small areas of ferrite occur, as against, in the 0.25 per cent carbon steel, one consisting of ferrite in which relatively small areas of pearlite occur.

High-Tensile Steels

When we speak of high-tensile steels we mean alloy steels containing suitable quantities of nickel, chromium, vanadium, etc., which by simple heat treatment may, in suitably large masses if necessary, be put into such conditions that they will give 50 to 70 tons tensile strength, accompanied by a good elongation.

To produce the final condition of a high-tensile steel, the steel must be first hardened with a view to producing a homogeneous solid solution phase, and then must be tempered to such a temperature as will leave the steel just in that condition in which it will give the tests required. The special elements present, such as nickel and chromium, enable the hardening operation to be effectively and easily performed, whilst they also, in a similar way, influence and render more complete control of changes taking place upon heating for tempering.

Air-Hardening Steels

Air-hardening steels seem to me to be extremely important, and I venture to predict that when they are more completely understood will be used to a much greater extent than at present. The difference between an ordinary high-tension steel and an air-hardening steel consists in the fact that an air-hardening steel heated to temperatures of 800-850°, and allowed to cool in air, will have great hardness, whereas the hardness so introduced by the same treatment in an ordinary carbon, or even high-tension steel, is in no way comparable. When we say that by simply cooling in air this steel becomes hard we mean that the rapidity with which the article will cool in air is quite sufficient to cause an almost complete suppression of the thermal change which is responsible for the breaking down of the solid solution into the pearlitic condition. Such air-hardened steel will, on air-hardening from temperatures from 800-850° C., give 100 tons per sq. in. maximum stress and upwards, accompanied by elongation in the neighborhood of 10 per cent. Such figures would seem to me to be extremely valuable to the engineer designing parts such as you are interested in, and one cannot but think that as time goes along much greater use will be made of it.

Stainless Steel

This high-chrome steel has been selected as one of the typical steels because it represents an entirely new departure. The stainless and non-rusting properties of this steel were discovered in the Brown-Firth Research Laboratory during the time of my predecessor, Mr. Harry Brearley, and since that time its uses for various purposes have developed until the material now occupies an important position amongst special alloy steels. It is a low carbon steel containing 11-15 per cent of chromium. The steel is an air-hardening one, and consequently requires working with care, but as experience accumulates in the handling of it, practical difficulties, even in the handling of considerable masses, will, no doubt, be eliminated. In the sub-division on hardening and tempering a full set of figures relating to this steel in its various determined conditions will be found. This steel has the decidedly unique property of successfully resisting the ordinary corrosive action of the weather, change from wet to dry atmospheric conditions, organic acids, oxidizing influences, and sea-water. As an instance, a polished surface of this steel may be placed in the garden during any period of the year and left for two or three months, after which it will still be perfectly bright and unrusted. It would seem to me that for seaplane work this steel should have quite a large application. It is at present used for aero valves in the place of high-speed steel, and certainly would appear to form a possible material for making stream-line wires, etc. Owing to the excellent mechanical properties which can be obtained from this steel by hardening and tempering—which mechanical properties are accompanied by the rust-resisting properties—it would seem that for structural parts its use will become more general as time goes on.

Manganese Steel

Manganese is added ordinarily to steel to make it forge well, *i.e.*, to eliminate oxygen, and to more than neutralize any sulphur which may be present. It incidentally strengthens the steel even when present in quantities much under 1 per cent. The steel we are considering, however, under the above heading is the special high-percentage manganese steel containing 11-15 per cent of that element alloyed with the steel for the special purpose of obtaining those peculiar properties of the alloy discovered by Sir R. A. Hadfield something like thirty years ago. The influence of added elements upon the carbon change-point has already been discussed, and it is useful to here record that as the manganese content added to steel is increased, the carbon change-point on cooling is depressed so thoroughly that in the case of this special steel it does not occur even by the time that ordinary temperatures are reached, the result being that ordinary cooling really has the effect of producing the hard, unresolved condition of the material. If this steel be quenched from temperatures approximating to 950°, the well-known tough, non-magnetic condition of the material is obtained.

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‡‡McWilliam and Barnes.

Much research work has been done upon this steel, and it is important to record that whereas tempering softens ordinary carbon and alloy steels, if a sample in the condition just referred to (quenched from 950° C.) be tempered, it actually becomes progressively harder and magnetic. After such treatment the great toughness and non-magnetic properties can only be restored by a further quenching from a suitable temperature. (The mechanical properties of manganese steel sheet have been indicated in the table.

To assist the engineer in avoiding needless worry, it would perhaps be well to point out that commercially this manganese steel cannot be machined (although in sheet form it is easily punched and sheared). The best way of dealing with it, if it is to be used, is to forge to shape, water toughen, and then finish by grinding. Its uses need not be more fully discussed here, but it is considered that the material is of sufficient importance to have required some general indication as to its properties and structures.

Twenty-Five Per Cent Nickel Steel

It is, on the face of it, a curious fact that two magnetic materials such as iron and nickel should, when alloyed in certain proportions, produce a non-magnetic alloy.[§§] A steel containing 25 per cent nickel has this and other valuable properties. As previously pointed out, some elements lower the magnetic and carbon change-points in iron, and this particular percentage of nickel lowers them to something approximating to 40° C. The result is that if the material does not reach temperatures much below normal ones, this steel remains in a non-magnetic condition. It should, however, be pointed out that the nickel must be reasonably near 25 per cent, say within a range of 24.5-27.5, for satisfactory results, with the carbon in the vicinity of 0.30 per cent. The manganese should also be kept low. For anyone particularly interested in this steel reference might be made to a compilation recently published.[¶¶] Microscopically, such steel will, when put in its best condition, consist of polygonal grains or allotrimorphic crystals of solid solution or carbide of iron and nickel in iron containing nickel. The mechanical properties of this steel are of similar order to the manganese steels, the distinctive feature being the low elastic limit and a slightly lower modulus of elasticity.

With regard to this steel, our experience has been that a little chromium has several advantages. In the first place, it seems to improve the machining properties without deteriorating the non-magnetic properties, and incidentally assists in preventing any precipitation of the carbon in the free condition. (The Brinell reading of this specimen gave 2.40 impression, 652 hardness number.)

These high-nickel steels, particularly when they contain percentages from 27-32, are claimed to be rustless, and are used considerably for valves, boiler tubes, etc. This rustless property tends, however, to be somewhat fugitive, and such steel is apparently losing favor in that direction, especially in view of the introduction of the high-chromium "stainless" steel. A good deal of research work in this field will lead to a more complete understanding of its properties.

Sheet Steel

A considerable tonnage of sheet steel is employed in aero work. The supply of sheet steel possessing definite physical properties has been brought very much to the front of late, and there is admittedly much to be learned both by the maker and user. The present method of manufacturing clips, etc., from such steel is worth looking into. These are usually bent to various complicated designs in the cold state by means of the hammer and vise. In order to stand this rough usage, the steel must be supplied of such properties that it will withstand bending double in any direction over itself; it is quite possible to imagine a man who is bending a clip over to a template bending it too far and then having to bring it back again, possibly more than once, producing extreme local cold work. Considerable local strain is put upon the metal. The steel used for such purposes has usually a low tensile strength, say 28-30 tons. A higher class of sheet steel is being used containing nickel which gives approximately 35 tons tensile with a considerably higher yield-point than the mild steel. A drawback against this latter steel is that there is some difficulty in working it.

As the demand for lightness with strength is such a vital matter, it is quite easy, from the steel manufacturer's point of view, to supply sheets which, when heat-treated, will readily give a tensile of 50 tons, combined with a fairly good elongation, and sheets capable of tensiles up to 100 tons can be supplied, providing that sufficient care is taken by the aeroplane builders to treat this steel in a very careful manner. I would suggest that whenever high-tensile sheets are required the parts should be pressed in the machine, and in this way the possibility of overbending, accompanied by the alternate bending, will be eliminated. For those parts which cannot be pressed in bulk, it is suggested that a nickel-steel sheet be used which will stand bending over double and which, when suitably heat-treated after bending to shape, will give a tensile strength of upwards of 40 tons, with a corresponding high yield.

A considerable number of complaints have come to my notice in the past of failure during the bending of this sheet steel, and this has been largely due to the fact that the edges, after shearing, have not been properly dressed, more often than not even small cracks remaining. This results in a ready local accumulation of stress with subsequent local failure. Especially does this occur when the pieces have been roughly cut by means of a chisel.

Welding—This question of small parts made from sheet steel raises the subject of welding. To my mind welding in any form should be looked upon with disfavor in connection with aero work. The skilled welder even may think that he has made a good job of a weld, but it is usually almost certain that a metallographist could demonstrate that he has not done so. The drawbacks are twofold. First, the material has to be put into a bad (most likely burnt) condition in the neighborhood of the weld, and, secondly, unless the welder is a perfect artist, he leaves oxides lying in the path of the weld. One does not want to condemn welding in a general way, and whilst welding is, in other fields, a useful process, it seems to me to be a little too risky in aero work if you can possibly dispense with it.

Cast Iron

Since cast iron is used for cylinders and pistons, a few words are probably in place. This material can be conveniently looked upon for the purposes of our comments as a steel matrix containing silicon in solution which is cut up by graphitic plates and free phosphide. If cast iron is suitably made it is strong, and has other properties which experience has shown make it useful for the purposes for which it is used.

It is well worth the while of engineers to look into this question of composition, particularly with a view to obtaining a suitable silicon content. If the silicon be too high, a weak iron is obtained, whilst if it be too low the fins, for instance, of cylinders will consist of "white" iron and be much more easily broken. A variation in composition without a corresponding modification in feeding arrangements would lead to unsound and unreliable castings, and, therefore, whatever else is arranged, compositions, when once selected for a particular purpose, should be consistently maintained.

Forging and Drop Stamping

When considering the question of the work that has to be put upon steel, it almost seems a platitude to say that the steel must be well soaked and forged at a proper temperature; yet experience teaches us that it is well worth emphasizing on every possible occasion since so much trouble has arisen, and is arising, from this cause. The alloy steels, too, should be heated up slowly and with care, particularly from the cold until they are thoroughly warmed through, and any experienced forgeman will confirm the great advantage of properly soaking the material. Internal rupture of the material is quite possible with undersoaking, whether it be due to ignorance or to rushing production. There is another aspect of the forging question, *i.e.,* different parts may be forged in different ways, and there is probably no better example than a crankshaft. In this connection not only must it be considered as to how much work may be locally put on the material, but also where the forging operation will leave the central, less homogeneous, and less reliable portion of the material. The method of stamping aeroplane cranks by which the bloom is forged to crank shape in two or three heats has been advanced as a desirable method. This, however, like most other processes, is open to criticism. To satisfactorily produce a crankshaft by this means, the temperature of the material must be judged with great care, as, owing to the severe punishment which the steel locally receives, it may even be permanently injured. One point, however, which does seem to me important and worth emphasis is that the several parts shall receive a requisite amount of work and a minimum of re-heating upon parts not subsequently re-worked, the work being put upon the material at suitable temperatures.

My friend Mr. Stubbs[‖‖] has already dealt recently with drop stampings for the automobile industry, and his remarks *re* the technique apply obviously equally well to aero work. As he says, "drop forging may be defined as the art of causing metal in the hot and plastic state to flow into cavities formed in one or both of a pair of dies." Obviously, then, the art will depend largely upon the skill of the drop-stamper in determining the correct temperature at which to work his steel. This temperature must necessarily vary with different steels, some permitting liberties to be taken whilst others will not, and also with the size and configuration of the stamping. Some of the steels used in aero work need extremely careful handling if drop stampings are to be made from them, whilst there are other steels which probably the drop-stamper will be wise to avoid. It will be appreciated that if certain designs of parts are to be produced, owing to the unavoidable difficulty as regards configuration, some steels are probably immediately excluded, and here is only one direction where the drop-stamper and designer can well afford to consult and to take advantage of the steel-maker's experience. Many faults are put down to the steel which can most likely be attributed to the stamper's lack of familiarity with the idiosyncrasies of the materials with which he is dealing. Talking of the designer reminds me that much time, money, and subsequent worry can be saved if that original sinner will remember that the steel-maker, drop-stamper, and aero engine builder are frequently the heirs of trouble which he not infrequently bequeaths to them. Simplicity in design, absence of sharp corners, acute angles, deep thin ribs, acute bends, etc., are points perpetually held before him as things he should not perpetrate, and be it said there are some signs of improvement. The effect of over-heating for drop stamping has already been pointed out on several occasions, and the evil effects do not require any further emphasis. Working too cold is also undesirable, since it produces stresses in the material which may lead to subsequent trouble.

Before leaving the question of drop stampings a word might be said with regard to the heat treatment. Frequently a stamping will be of very unequal thickness in its drop-stamped condition, whereas after machining it will have attained probably fairly uniform thickness. In such cases it would seem to me desirable that the heat treatment should be done after rough machining, as, otherwise, it is extremely likely that the material in the heavy part of the forging will not have been put into the same condition as that in the portion of ligher section.

Normalizing and Annealing

The terms "normalizing" and "annealing" are loosely applied to a variety of operations in a steel works. Steel in the forged or rolled condition is in a strained state, and in order to destroy the stresses remaining from these operations it is necessary to re-heat the material. This may be accomplished by either of the operations under discussion, but in addition to the necessity for removing stresses it is often necessary to also soften the material by entirely modifying its structure. The actual operation of normalizing consists in heating the steel above the Ac3 point and allowing to cool in air free from draughts. Annealing is a much more thorough treatment, involving a knowledge of the behavior of the various steels under varied conditions. The original method of annealing was to heat the steel to a high temperature, maintain that temperature for a varying time, and cool very slowly. This is quite satisfactory for many steels, but in some of the alloy steels better results are obtained by heating to temperatures below the carbon change-point and cooling in air or in the furnace. It may be of interest to include the I.A.E. Steel Research Committee's definition of these terms:

(To be continued)

[¶¶] "Invar and Related Nickel Steels."

[§§] Noted by Professor Hopkinson in 1889.

[‖‖] Institution of Automobile Engineers, 1915.

THE GERMAN AEROPLANE ENGINE TRIALS

IN these trials it was only found to be 5.6 h.p. per 1,000 c.c. as compared with 11.5 h.p. obtainable from a stationary water-cooled engine. Owing to the high temperatures it is not advisable to use large cylinder bores, and it was on this account that the bore of the 80 h.p. Gnome was smaller than that of its predecessor, the 70 h.p. engine. The cylinder and piston of this engine are shown in figs. 1 and 2. These views show the well-known L-shaped brass packing ring fitted to this piston, which proved to be quite satisfactory in contradistinction to cast iron rings which are liable to carbon up and seize.

The power obtainable per unit of cylinder capacity depends chiefly on the efficiency of the heat dissipation from those parts of the combustion chamber which are not in direct contact with the cooling medium, *i. e.*, the piston and valves. The heat from the piston head must obviously be conducted away down the skirt, through the oil film and cylinder walls to the jacket; and it is for this reason that aluminum pistons, as now used, generally effect such a marked improvement, and in some cases have enabled mean effective pressures to be attained which until recently were deemed impossible.

Of course, some of the heat is conducted away to the fresh charge and the lubricating oil, but absorption in this way is small, and clearly the larger the bore the more difficult the heat dissipation, so that in a highly efficient engine one soon arrives at a limit.

In the graph shown in fig. 3 the h.p. per unit of capacity can be seen to decrease as the bore increases, showing that with large bores the pressures had to be reduced. A high output per unit of capacity results, of course, in a greater quantity of heat to be absorbed per unit of piston surface, so that with large bore engines the compression must be made lower. This limits the bore. For practical reasons there is a limit to the stroke, and in this way the bore and stroke are both limited.

Many years ago it was assumed that by employing a large bore and a short stroke one produced a light engine. This may have been the case when engines were far less efficient than they are today, but the majority of high output engines for aeroplanes or for racing cars have comparatively long strokes and small bores, due to the piston cooling.

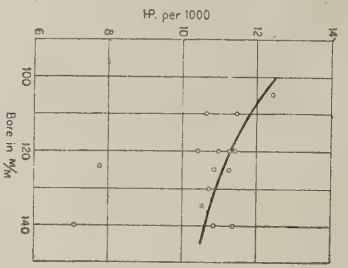


Fig. 3.

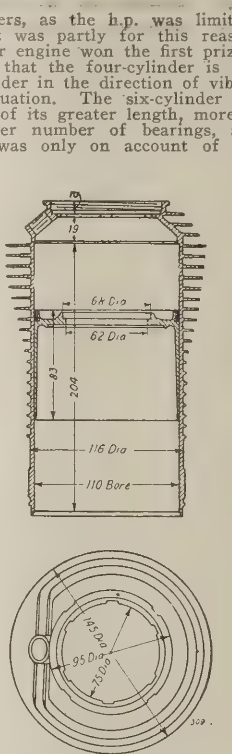
When the dissipation of heat from the piston becomes insufficient the crown of the piston becomes red-hot and pre-ignition occurs. This excessive heating may extend even to the edge of the piston, and in some cases lubrication troubles, both of the piston surface and the gudgeon pin bearings, arise, and the piston rings commence to foul and carbonize up, so that the power falls off for a number of reasons. In extreme cases the top of the piston cracks, and gas leakage through these cracks takes place, an example being shown in fig. 4. The next step is for the piston to seize.

From this it follows that the cooling of the cylinders is most important, and one of the most interesting lessons learned from these trials was the value of the steel cylinders which were used in one engine, whereby the thickness of the wall could be reduced and better cooling obtained. The engine which was fitted with steel cylinders actually showed the highest h.p. per unit of capacity, which bears out these conclusions. In the case of the 80 h.p. Gnome engine, which, of course, is air-cooled, the h.p. per unit of capacity is practically half that of the best water-cooled engine.

Incidentally, the value of offsetting the cylinders to reduce the side thrust, and thereby the heat generated by the piston friction, was noticeable. An engine with offset cylinders can only be used for rotation in one direction, which is sometimes a drawback.

In consequence of the limitations with regard to cylinder bore stroke, and heat dissipation, it was found in these trials that the maximum h.p. obtainable per cylinder was from 25 to 28.

In order to obtain low petrol consumption (and therefore low weight of fuel and oil), most of the competitors entered large bore engines of four cylinders, as the h.p. was limited to 115 h.p., and it was partly for this reason that a four-cylinder engine won the first prize, in spite of the fact that the four-cylinder is inferior to the six-cylinder in the direction of vibration and torque fluctuation. The six-cylinder is heavier on account of its greater length, more extensive piping, larger number of bearings, and detail parts. It was only on account of the better cylinder cooling due to the employment of steel cylinders that a six-cylinder engine was able to take second prize.



Figs. 1 and 2.
Gnome cylinder and piston.

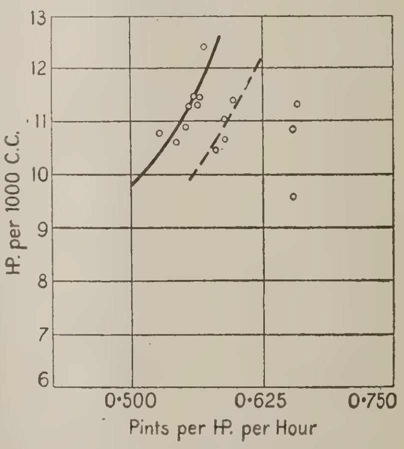


Fig. 5.
Increase of petrol consumption with increasing output.

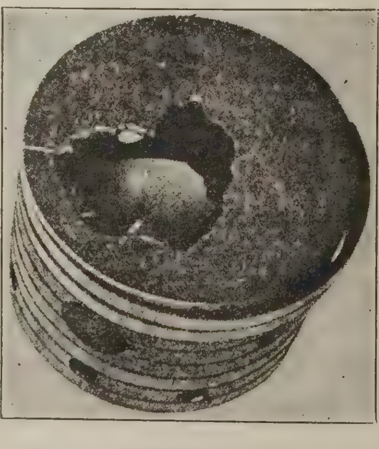


Fig. 19. The result of a broken valve

To cut down the consumption of petrol and oil most competitors ran their engines at about 5 to 6 per cent below the maximum output, as above this point the consumption increases very rapidly. Restricting the power in this way improves the figures obtained in the duration tests, and incidentally the heat variation was reduced and the life of the engine increased.

The consumption figures for the different engines have previously been given. Before the main tests competitors were permitted to tune up their carbureters, for which purpose the graduated glass flask, referred to in Part I, was found to be of very great value. Carbureters very finely tuned up, as these were, are extremely sensitive to variation of temperature and air pressure. With quite a small variation it was found that the power output and speed quickly fall, and consequently one does not find in practice such low consumption figures as were obtained in these trials.

An interesting graph, fig. 5, shows the relationship between the h.p. per unit of capacity and fuel consumption, and it will be noticed that the results lie in three groups, representing low, moderate, and high consumption, and it may be of interest to mention that the exhaust gases in the three cases were of distinctly different coloring. When the left-hand groups of results were obtained the exhaust flame was reddish blue, indicating complete combustion. The central group produced an exhaust flame which was reddish yellow, whilst the right-hand group was obtained when the exhaust gases were yellow and smoky, due to imperfect combustion. The left-hand curve of the graph shows clearly how the consumption increases with the rising h.p. per unit of capacity. The consumption is also largely influenced by the bore-stroke ratio, as shown in fig. 5a. On this chart a mean curve has been drawn, dividing the group into two. The left portion represents consumption values in cases where the output is less than 11 h.p. per 1,000 c.c., whilst the right-hand results were obtained when the output is in excess of 11 h.p. per 1,000 c.c. The petrol consumption for a bore-stroke ratio of .7 is about .528 pint per h.p. per hour, and increased to about .592 pint per h.p. hour with a bore-stroke ratio of 1.

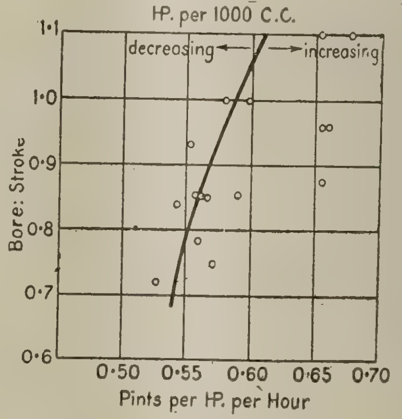


Fig. 5a.
Influence of stroke-bore ratio on petrol consumption.

In most cases the compression ratio is rather small, about 4.5 to 4.7 to 1, owing to the fear of pre-ignition. Generally the combustion chambers were of good shape, figs. 6 and 7 being typical.

Carburation

There is no uniformity shown in the type and disposition of the carbureters. Where two jet carbureters were used in all cases only the main jet was employed at maximum speeds. Naturally, engines with multiple-jet carbureters could be run slowly and were easy to start. One large carbureter results in a lower consumption than two small ones, and is more reliable, owing to reduced liability of chokage of the jet passages. When two carbureters were used it was found that the engine would not run at all usefully on the one carbureter. In the case of six-cylinder engines two carbureters were found advisable to prevent interference in the induction pipe, due to the reversal of flow of the charge. Most of the carbureters employed used automatic air valves admitting air in the same direction as the main flow, but in a few cases the air valve was positively coupled to the throttle valve or to a lever varying the jet outlet.

Some interesting conclusions were arrived at with reference to the heating of the charge. In most cases hot water jackets were used, but this was found to be insufficient, as best results were noticed when both the main and additional air supplies were slightly warmed, as, for instance, by being drawn across the crank case before reaching the jet.

In addition it was desirable that the mixture should be heated by means of water jacketing, and that this heating effect should be controllable. Variation in the length of the piping between the carbureter and cylinders was not found to be detrimental, as the importance of uniformity in this respect is chiefly connected with low speed running. It was found, however, that those parts of the inlet pipes which were exposed to the propeller draught had to be protected, otherwise they were excessively cooled and petrol condensed at these points. For this reason, and in order to prevent excessive cooling of the front cylinders, it is suggested that the front of the engines should always be screened from the direct blast of air.

Lubrication

It was found that the consumption of oil varied largely with the type of lubrication system employed. A point to be taken into consideration is that in aeroplane engines the oil serves largely to cool the piston head, and therefore it becomes very hot. Partly for this reason the loss of oil is rather large, due to some extent to loss in vapor through the crank case vents, but naturally the chief loss is past the piston. To reduce the amount of oil traveling up the cylinder walls a baffle was in one case fitted across the bottom of each cylinder, see fig. 8. Where a complete forced system is used, and where the oil is being conducted to the gudgeon pin by a tube along the connecting rod, fig. 9, the loss is naturally smaller.

In one case the vent pipe was made long and was exposed to the draught of air, so that the vapor condensed and the oil so collected could have been used for lubricating parts outside the crank case. The amount of oil leaking past the valve tappets and push rods can be considerably cut down by making the diameter of the projecting parts of the tappets as small as possible.

In one engine the vent pipes were extended very high and served to enclose the push rods, and also to lubricate the ends of the rockers (see drawing of the Mulag engine previously published).

As the oil increases in temperature its lubricating qualities decrease, and therefore a thorough circulation system with plenty of opportunity for cooling was found strongly advisable. In some cases, which have been previously alluded to, the air for the carbureter or the mixture is drawn along a pipe through the crank case. Castor oil was found to be best for air-cooled engines, owing to the fact that at high temperatures it retains its qualities better than mineral oil, but for water-cooled engines mineral oil was quite satisfactory.

Some of the engines entered for the competition were lubricated by splash, but an abundant supply is needed, so that in these cases the consumption was very heavy and the exhaust generally smoky. The following illustrations give details of the various forced systems employed.

In fig. 9 it will be noticed that the oil is picked up by an annular scoop attached to each crank web, this oil being that which exudes from the adjacent shaft bearing. The oil finds its way to the connecting rod bearing by a duct, and a tube leads it to the gudgeon pin bearing. In fig. 8 grooves are turned in the crank webs, which collect the oil exuding from the shaft bearings and conduct it to the crank pin. In addition to this the crank pins are lubricated by oil, which enters the hollow crankshaft and flows by radial passages to the crankpin. These passages also collect the oil thrown by centrifugal action over the surface of the crank web and into the groove, centrifugal action presumably preventing the oil being thrown out at the junction between the groove and the passage.

In the arrangement shown in fig. 10 the crankshaft is hollow, and the oil is supplied to the shaft portions, and flows along the hollow webs to the pins. Lubrication of the gudgeon pins is, however, by splash. In view of the high pressures required to force the oil against centrifugal action to the center of the shaft plunger pumps are recommended on account of their pulsating action. In some cases the oil sump was arranged to contain but a small quantity of oil, which was constantly circulated (fig. 11), and in a few cases there was a second system supplying fresh oil. In some (see fig. 15) this fresh oil was supplied to the same oil main as the used oil, but in other cases, as is shown in figs. 12, 13 and 14, the fresh oil was supplied by separate pipes to the crankshaft bearings quite distinct from the circulating system. To some extent, therefore, this provides a duplicate lubrication system, but the fresh oil which is capable of being supplied in this way would not last very long. Filtering of the oil presents no difficulties, and it was actually found that the small carbon particles which passed through the gauze filters improved the bearing surfaces. In a few cases the oil pumps were so placed as not to operate satisfactorily with the engine tilted in either direction. The best position in this respect is shown in fig. 15.

The oil consumption in relation to h.p. per

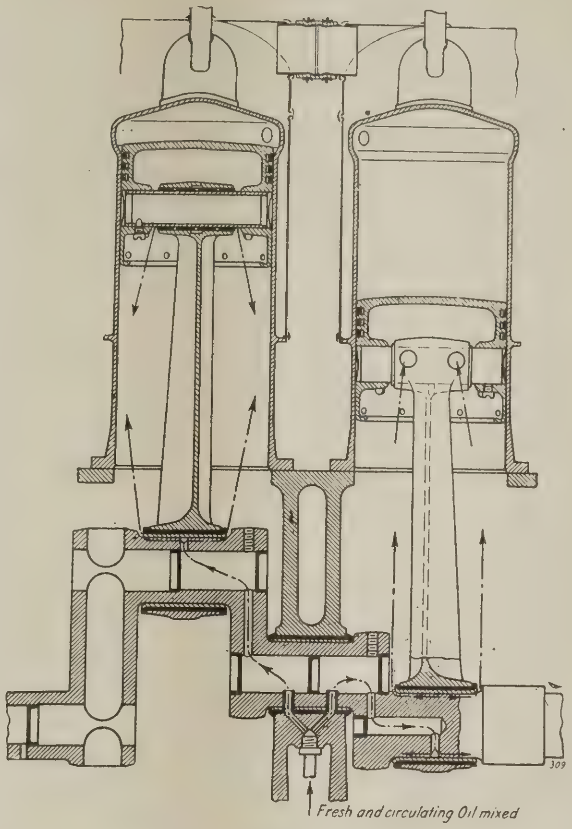


Fig. 10.
Oil circulation through hollow crankshaft.

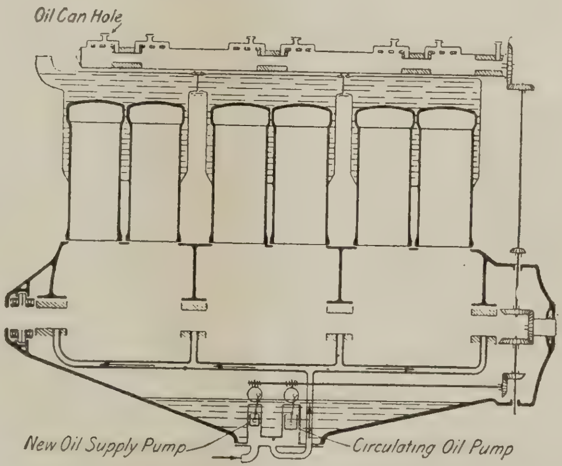


Fig. 15.
Two oil pumps, one for fresh and the other for used oil, both feeding into a common oil main.

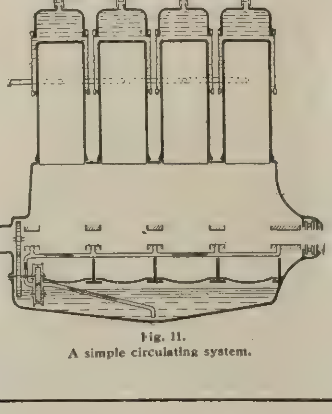


Fig. 11.
A simple circulating system.

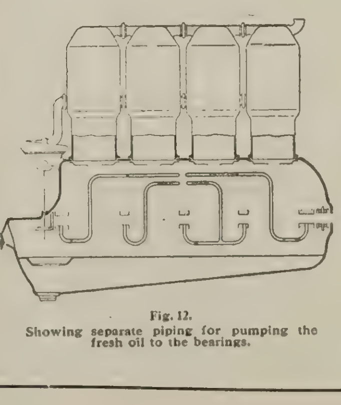
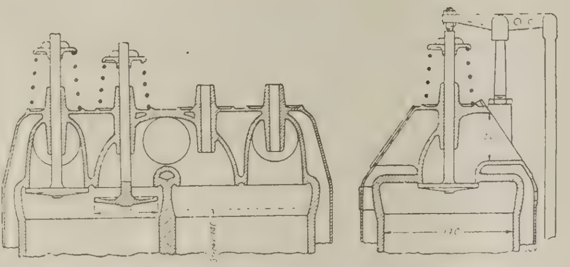


Fig. 12.
Showing separate piping for pumping the fresh oil to the bearings.



Figs. 6 and 7.
Cylinder head with cast water jacket.

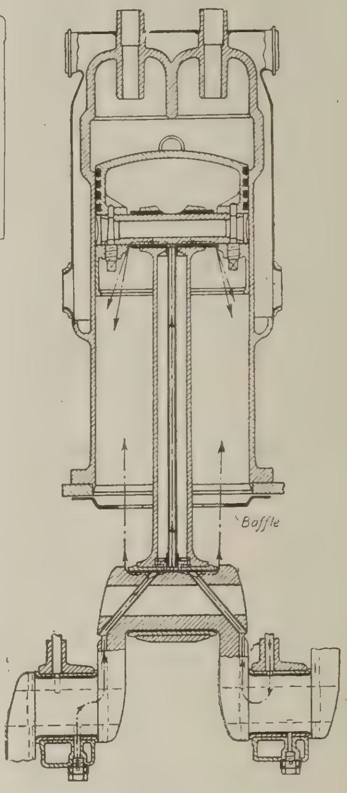


Fig. 8.
Oil feed from main bearings to connecting rod ends and thence to cylinder walls.

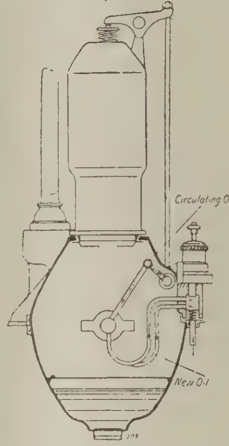


Fig. 13.
Showing the pump and piping for the fresh oil.

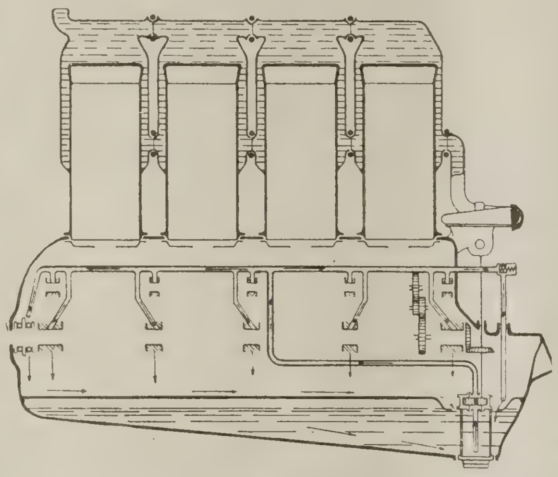


Fig. 14.
Showing the pump and piping for supplying the circulating oil.

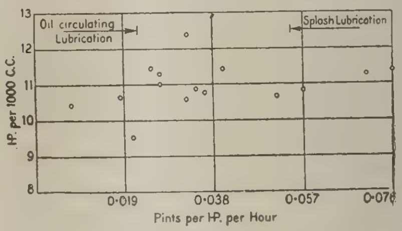


Fig. 16.

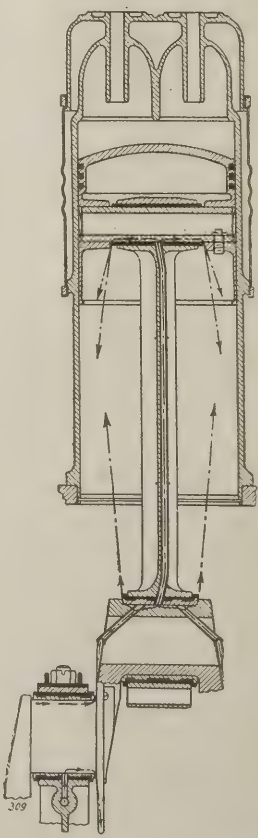


Fig. 9.
Lubrication of big ends by circular oil catchers that collect oil issuing from main bearings.

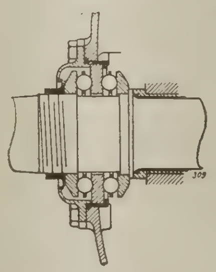


Fig. 28.
Double ball thrust bearing.

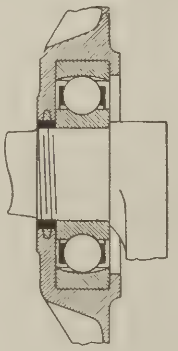


Fig 26.
Radial ball bearings.

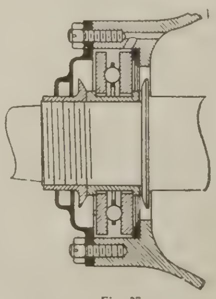


Fig. 27.
Single ball thrust bearing.

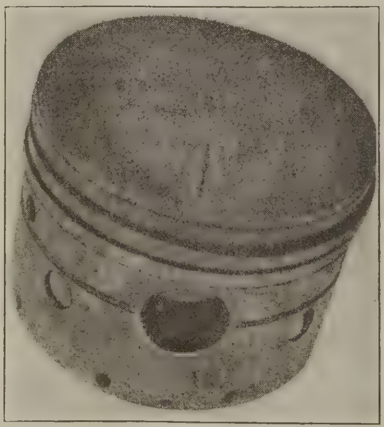
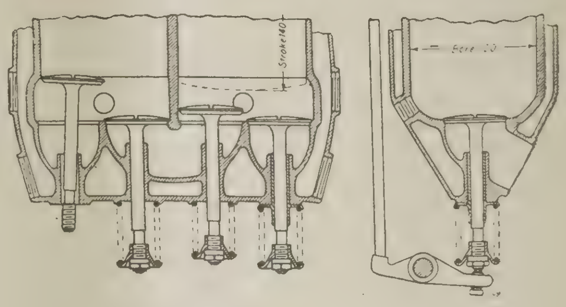
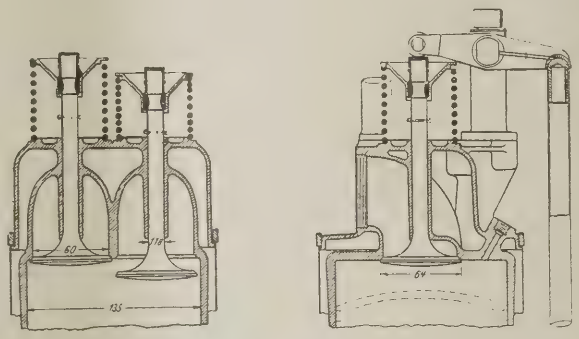


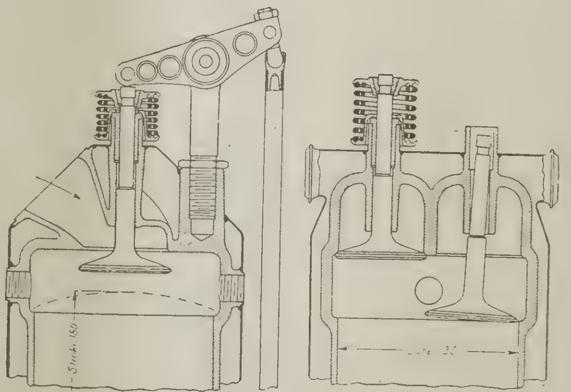
Fig. 4. Example of an overheated piston showing radial crack



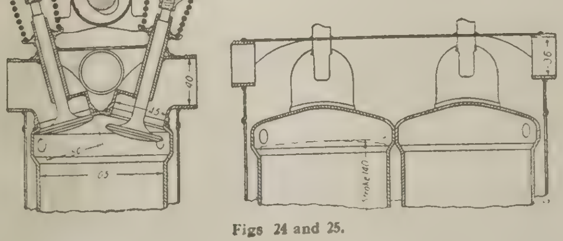
Figs. 17 and 18.



Figs. 20 and 21.



Figs. 22 and 23.



Figs 24 and 25.

1,000 c.c. capacity is shown in fig. 16. The results shown at the left-hand side of the diagram were obtained with circulating systems, and those on the right relied upon splash, which shows graphically the advantage obtained by employing a proper system.

Ignition

As showing the reliabiilty of the ignition systems available at the date of the trials it may be mentioned that not a single engine suffered from any serious trouble, not even from a sparking plug. The immunity from plug troubles was stated to be due to the method of fixing the insulator by spinning over the body of the plug. The reason for this is the large contact between the metal body and the insulation, so that the heat is conducted away and the plug is rendered permanently gastight. The latter point is important because if there is any leakage oil and carbon pass up and the plug breaks down. It may be of interest to state that sparking plugs were not perfect, and that the part of the insulator which projects into the cylinder bore evidence in most cases of having become very hot, so that it became pitted and blistered, and in many cases was on the point of breaking down or becoming incandescent. Most of the engines had two sets of sparking plugs connected with separate magnetos, but in a few cases a double spark magneto was used. By using two sparking points the combustion is naturally more rapid and the amount of heat lost to the water jacket was smaller, though the gain in power and efficiency was small but noticeable. Chief trouble was experienced with breakage of the high-tension wires due to the continuous vibration to which they were subjected. The best position for the magneto was found to be behind the cylinders, where it was screened from the air draught and readily accessible. When the magnetos were exposed to the full air draught they became very cold and some trouble was experienced from moisture condensing upon them. Contrary to expectations, this even occurred with magnetos of the so-called "waterproof" type.

Constructional Details

One of the most striking lessons obtained from these trials was the advantage gained by using steel cylinders, which has previously been alluded to. In consequence of the thinner cylinder walls available the compression could be raised without increasing the pre-ignition point, and therefore the mean effective pressure was higher.

In order to accommodate large valves without enlarging the combustion chamber above the bore the valves were sometimes inclined or mounted in bushes, but in some cases the stems were made of two diameters, as shown in figs. 17 and 18, which make clear how this enables the valve to be tilted just sufficiently to clear the shoulder at the top of the combustion chamber. Overhead valves rendered efficient cooling of the stems and their bearings difficult, and it is very important to eliminate any side pressure on the valve stem subjecting it to a severe bending stress. In one or two cases trouble was experienced through valves breaking when the heads fell into the cylinders and did damage as shown in fig. 19. To prevent the spring exerting any side pressure due to tilting in one case (see figs. 20 and 21) the spring washer was free to rock upon the valve stem by means of a spherical mounting.

In all cases but one the valve seats were machined in the cylinder casting.

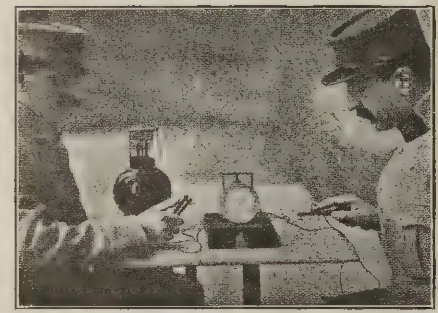
Some interesting variations in cylinder design and construction were to be noticed. In many cases, as illustrated, for example in figs. 20 and 21, the tops of the jackets were cast integral with the cylinder walls, and the main length of the jacket was of sheet metal held in place by rings. This enables the cylinder barrel to be machined inside and out, and only the upper portion of the water jacket was left unmachined. In figs. 22 and 23 the construction adopted goes still further and allows even this part to be machined, the water jacket being welded to bosses formed at different points. The next stage is shown in figs. 24 and 25. Here the cylinder is of steel, and the gas passages, valve guides, and water jackets are all welded together, so that the whole cylinder element is built up out of small parts welded together.

A point that must not be overlooked is the expansion of the crankshaft as it heats up, and such expansion must be allowed for without interfering with the means for receiivng the propeller thrust. Sufficient side play must be allowed in all but one of the crankshaft bearings for this reason. The ball thrust bearings shown in figs. 26, 27 and 28 were found to be quite satisfactory. The first of these shows a ball bearing designed to take radial and thrust load. In the second instance there is a single thrust bearing which is made to take load in both directions, whilst in fig. 28 is shown a complete double thrust bearing.

There was considerable variety in the methods adopted for fixing the propellers to the crankshafts, and this led to much delay at the commencement of the trials owing to the necessity for making special hubs for each engine. In one case the propeller had to be bored out so much that it broke during the trial, and it was recommended to standardize both the attachment of the propeller and the dimensions of the crank case hangers.

MEDICAL AND PHYSICAL TESTS FOR AVIATORS

IT has long been recognized that a recruit for the active branches of the Air Services should possess special physical qualities and aptitudes, in default of which he is unlikely to reach the required state of efficiency. What those particular characteristics are it is difficult to lay down with any degree of exactitude, since the personal factor counts for much, and it is quite possible, as various critics have recently remarked, that a recruit failing owing to temporary loss of nerve, or suffering from what is colloquially known as "cold feet," may in fact become an efficient pilot, whereas another after having passed the most stringent medical tests may eventually prove a "wash-out." Whatever the precise nature of the physical qualities wherewith the budding airman should be endowed, the extreme value of a preliminary medical examination cannot be gainsaid. The French system of medical tests has recently been referred to more than once; accordingly, it may prove of interest to set it forth at length as practiced by Drs. Camus and Nepper, and applied to candidates for the French Air Services. Our thanks are due to the courtesy of our contemporary *L'Aerophile* for the facts on which this article is based.



Candidates for the French Air Service have first to pass the usual military medical tests applied to all ranks of the Army. In addition they have to pass a far more severe special examination subsequently. Those who fail in any respect are incontinently rejected, but it is of interest to note that ordinary physical disabilities which would cause a man to be rejected for the other branches of the Army form no bar to a candidate's acceptance for the aerial arm, and justly so; for there are, as a point in case, several one-legged aviators who possess a fine military record.

In an official circular issued on March 31, 1916, it is laid down that candidates for the Air Service must possess, in addition to complying with the ordinary medical standard:—

(1) Normal vision of each eye (no optical instruments allowed);

(2) Correct colour vision;

(3) Normal auditory powers and soundness of the middle and inner ear, particularly with regard to the sense of balance, which is determined by the latter organ;

(4) Perfect fitness of the respiratory and circulatory systems.*

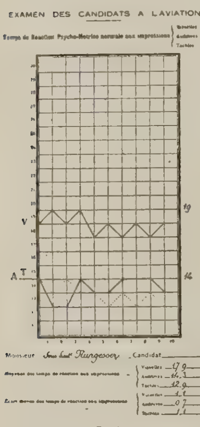


FIG 3

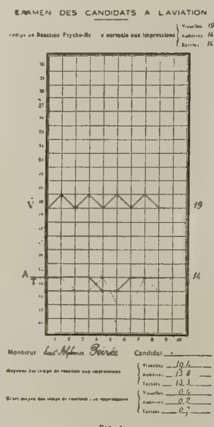


FIG 4

Circulation and Respiration

With regard to the respiratory and circulatory systems, the heart must be in good enough condition so as not to provoke attacks of faintness, and the lungs able to withstand variations in atmospheric pressure. Apart from this, these organs need not be perfectly healthy, since the purely physical effort required for piloting an aeroplane is not severe.

Sight and Hearing

Good sight and hearing are of primary importance, although there are exceptional cases on record of short-sighted men who are good aviators. The necessity for good visual power is obvious from the general point of view of flying. Further it is a most useful aid, especially in starting and in alighting, to gauge any variation in the angle of the machine relatively to its flight path, and enables its possessor to estimate his flying speed near the ground from the swiftness of the motion of the landscape underneath.

The sense of hearing enables a pilot to detect any variation in the rhythmic beat of his engine, and thus to control it. In gliding flight the whistling of the air through the bracing wires provides a useful indication of the speed to a practised ear.

The Sense of Touch

A third sense, that of touch, is also of considerable importance, though its possession cannot be localized in any specific organ of the human body, and is therefore more difficult to determine. An experienced pilot obtains most useful information regarding the attitude in flight of his machine from the ease or stiffness with which his controls are working. Again when his face is not protected he can tell from the manner in which the wind strikes it how fast the machine is flying, and even in some degree the direction of the wind.

These brief preliminary remarks show how important it is that these organs should be in good condition, and the special medical examination is designed to reveal any imperfections in their working, any unsuspected defects, and the manner in which they respond to outside impressions which reach them.

The Nervous System

No reference has yet, however, been made to point of first-rate importance—to the manner that is, in which the aviator will utilize the impressions thus received by his senses in order to convert them into the movements required to control his machine. This is purely a function of the nervous system, which varies widely in every individual.

Every impression received by the sense (eye, ear, or touch) is transmitted to the spinal cord or the brain, and thence to the muscles which are called upon to perform the necessary movement. "Swift as thought" is a common expression, but, however swift it may be, the process still requires time. It is swifter in youth than in old age and varies with external conditions, such as cold, fatigue, etc.

It has even been established that there is a time limit beyond which an impression following immediately upon another similar one is no longer clearly perceived. This minimum interval of time is about one-tenth of a second.

Now in all rapid locomotion, but particularly so in aviation, which has its being in three dimensional space, wherein any variation in the motion or any disturbance is perceptible only after it has already attained to a certain magnitude, it is essential to act quickly, as quickly as possible, under the pain of danger or death.

The good pilot is he who, the most quickly informed by his senses, responds to them as rapidly as possible, whose psycho-motive reactions, to use a physiological term, take the least time. Training and experience may improve these reflex actions, and shorten their duration, especially so by transforming, by dint of repetition until habit is acquired, into subconscious and reflex movements actions which formerly required the intervention of the brain—that is, of conscious thought and the will. But, all said and done, training can only improve that which already exists, and even then only within narrow limits, by increasing the speed by 1-100th to 1-50th of a second.

In fact, one frequently meets with cases of individuals who, otherwise perfectly healthy and normal, exhibit relatively slow psycho-motive powers, and who in this respect will never improve sufficiently, despite every attempt and the best will in the world, to become good pilots.

It therefore becomes quite important to determine in advance whether a man's nervous reactions are too slow or too uneven to enable him to become the highly-skilled aviator required for the present conditions of aerial warfare.

This object is achieved by measuring the speed of the psycho-motive reactions of candidates by special instruments. This is one of the proceedings adopted at the instigation of Dr. Marchoux, at present medical C.O. of Paris, by Drs. Camus and Nepper in their special laboratory at the Grand Palais, which has been instituted for the express purpose of selecting candidates for the Air Service according to true scientific methods. The work is now being carried on at this laboratory by Dr. Nepper with the aid of Dr. Binet, of the French Medical Service, whose monograph on the rhythmic heart-beat of the soldier in action is well known.

The Method Employed

The instrument used to measure the time of psycho-motive reactions is the d'Arsonval chronometer. This instrument has a dial, split up into one hundred divisions, across which travels a needle, actuated by clockwork for ten minutes continuously, at a constant speed of one revolution per second. Each division of the dial is therefore passed in 1-100th of a second. Being connected to a battery, the needle remains stationary by the action of a small electromagnet as long as the current passes, but by pressing a small button the clutch, as it were,

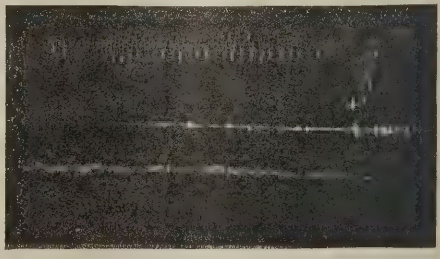


FIG. 5

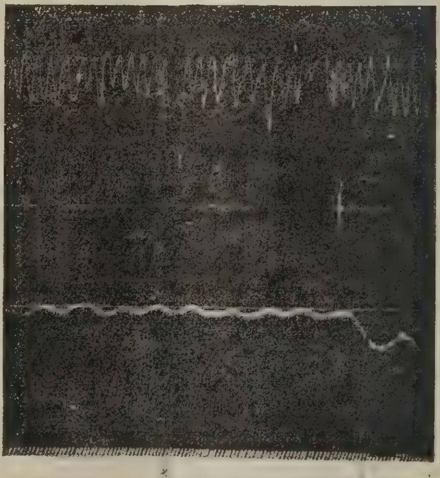


FIG. 6

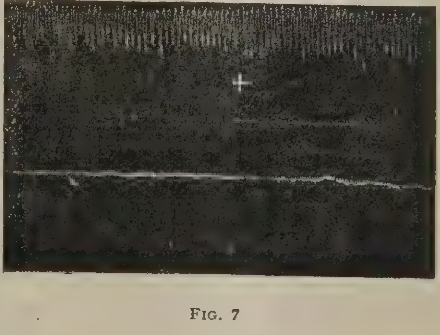


FIG. 7

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*The circular also lays down the maximum weight of candidates, which must not exceed 187 lbs. for pilots or 165 lbs. for observers (including uniform, but without special clothing or equipment). The medical history must be good.

MANUFACTURERS AIRCRAFT ASSOCIATION, INC., TO AID UNCLE SAM

In view of several erroneous statements which have been made in the public press, relative to the Manufacturers' Aircraft Association, Aerial Age prints the following statement issued by the Chairman of the Publicity Committee, Mr. Fay L. Faurote.

At a meeting held July 24, in the law offices of Crisp, Randall & Crisp, the well known patent attorneys, the aeroplane manufacturers of the United States pooled their patent interests for the good of Uncle Sam and formed a new organization known as the Manufacturers' Aircraft Association, Inc. By the terms of their agreement the various patents owned by the individual members are to be taken over and so cross-licensed that their use may be made universal to all engaged in the industry. This action comes as a result of a number of conferences held in Washington by the members of the National Advisory Committee for Aeronautics and the officials of the Army and Navy and the Manufacturers' Aircraft Association.

In January, 1917, the Secretary of War and the Secretary of the Navy requested the National Advisory Committee for Aeronautics to investigate the aircraft situation and recommend a solution for the problem in patent litigation which had arisen between the Wright-Curtiss Corporation and the Curtiss Aeroplane and Motor Corporation.. As a result of these meetings a special sub-committee on patents was established at a regular meeting of the Executive Committee on February 10, consisting of Messrs. Charles D. Walcott, Chairman; S. W. Stratton; S. D. Waldon and Lieut. J. H. Towers, U. S. N. In May, 1917, Judge W. Benton Crisp, Mr. Frederick P. Fish (Mr. Fish was not able to serve and therefore Mr. Cahrles Neave, his partner, acted in his place) and Dr. W. F. Durant were added to the sub-committee on patents, the latter serving as acting chairman.

Previous to this time, Mr. Howard E. Coffin, Chairman of the Aircraft Manufacturers' Board, and a member of the Council of National Defence, and Mr. Sydney C. Waldon, of the Aircraft Production Board had had several conferences with the Aircraft Manufacturers, and at the time of the Aeroplane Show in New York suggested an association which later was formed under the name of the Aircraft Manufacturers' Association. Meetings were held in Washington on March 23, June 18, and July 10, 11 and 12, to which representatives of the Aircraft Manufacturers were invited. After many weeks of consultation and deliberations between the interested parties an agreement was drafted by Mr. Crisp and Mr. Neave and reported to the Executive Committee of the National Advisory Committee for Aeronautics, which agreement was finally approved by the Executive Committee. When these negotiations were started the task of bringing all of the parties interested together seemed unsurmountable, but actuated by patriotic impulses it was at last agreed at the last regular meeting of the Aircraft Manufacturers' Association held in Washington, that the cross-licensing agreement and license be completed, and a recommendation made for the formation of a corporation under the laws of the State of New York to be known as the Manufacturers' Aircraft Association, Inc. This recommendation was followed and for the purposes of keeping the organization free from partisan influences in order that the best interests of all stockholders thereof might be managed and directed during the first five years of its existence under a definite and fixed policy, it was decided to place the control of the association in the hands of three voting trustees, consisting of Judge W. Benton Crisp, Joseph S. Ames, the Professor of the Department of Physics of Johns Hopkins University, whom it will be remembered was recently sent abroad by President Wilson as a member of a Commission delegated to investigate scientific subjects, and Albert H. Flint, well known as the Vice-President of the L. W. F. Engineering Company and the Vice-President of the Aircraft Manufacturers' Association.

Of these three, one represents the Manufacturers' Aircraft Association, Inc.; one the Curtiss-Wright interests and the third is a neutral elected by the other two.

The directors of the Association are: Mr. Frank H. Russell, of the Burgess Company of Marblehead, Mass.; Mr. Albert H. Flint, of the L. W. F. Engineering Company; Mr. John P. Tarbox, of the Curtiss Aeroplane and Motor Corporation; Mr. Harry Bowers Mingle, of the Standard Aero Corporation; Mr. B. S. Foss, of the Sturtevant Aeroplane Company; Mr. George H. Houston, of the Wright-Martin Aircraft Corporation; and Mr. H. E. Talbor, Jr., of the Dayton-Wright Aeroplane Company.

The officers of the Association are: Mr. Frank H. Russell, of the Burgess Company, President; Mr. Albert H. Flint, of the L. W. F. Engineering Company, Vice-President; Mr. Harry B. Mingle, of the Standard Aero Corporation, Treasurer; and Mr. Benjamin S. Foss, of the Sturtevant Aeroplane Company, Secretary; and Mr. Benjamin L. Williams, Assistant Secretary.

Judge W. Benton Crisp, one of the trustees, well known as Henry Ford's attorney in the Selden patent case, the counsel for Curtiss in the Wright-Curtiss litigation, and representative of the Hudson interests in the Hudson crankshaft case, was retained as general counsel.

By the terms of the cross-licensing agreement any responsible manufacturer of aircraft, or one who intends to become a bona fide producer of same, or any manufacturer to whom the United States Government has given a contract for the construction of ten or more aeroplanes, or any person, firm or corporation owning or controlling United States patents relating to aeroplanes may become a party to the voting trust agreement, provided for in the by-laws, and can qualify as a member.

It is the purpose of the association not to curtail, but to open up the industry in order that the Government officials and aeroplane manufacturers may not at this time be under any improper or unfair restraints.

All patent litigation relating to aeroplanes between members of the association ceases automatically, and the aeroplane industry is therefore left free to expand to any limits desired or required by the unusual demands of the war.

Medical and Physical Tests Continued From Previous Page

is pressed home and the needle continues to rotate as long as the electric current is interrupted.

Visual Reflexes

For the purpose of measuring the lag of visual reflexes the candidate is seated before the dial, push-button in his hand and told to press the button the moment the needle stops (Fig. 1). The examiner sets the button revolving by gently touching the table with a small hammer; the current is interrupted, the needle begins to revolve and the candidate stops it, as soon as he sees its motion, by pressing the button with his thumb. The time taken by his visual reaction is measured by the number of divisions equivalent to 1-100th of a second or even less traversed by the needle in motion.

A similar method is adopted to measure the speed of auditory or tactile reactions, the candidate pressing the button the moment the bell is struck or he has felt the hammer touch his head.

In the case of those blessed with good auditory and tactile reflexes the lapse of time amounts to between 14-100 and 15-100 of a second—these figures being the average of ten consecutive operations; the visual reflex is slower and takes about 19-100 of a second (see Figs. 3 and 4, which reproduce the exceptionally good graphs of the pilots Foirée and Nungesser).

But this is merely a starting-point. An individual in order to become a good airman must not only react rapidly to an impression received, but such reaction must be neither excessive nor unbalanced; his brain must control it immediately; a sudden unforseen emotion—which constantly falls to the lot of the fighting pilot—must exert upon him only the smallest and briefest possible influence. In other words, he must always remain cool and level-headed.

The effect of sudden and violent emotions is perceptible in the cardiac respiratory rhythms and in action of the vaso-motor nerves. And these emotional reflexes are also studied under the Camus and Nepper system.

For this purpose a pneumograph is fixed on the thorax of the candidate and held in position by a tape passing around the chest; in one of his hands he holds a Hallion and Comte pressbutton (the pneumatic diaphragm of which transmits the variations in the blood circulating under the action of the vasa-motor nerves), and in the other hand he holds a Verdin recorder, which reveals trembling.

These instruments are each connected by means of a pneumatic tube to a drum placed before a Marey cylindrical recorder covered with lamp-black. Clockwork mechanism sets the cylinder revolving, and the oscillations of all these needles are transmitted on to the lamp-black chart. Thus are recorded: (1) respiratory rhythm; (2) capillary circulation; (3) trembling. The oscillations thus recorded, with their amplitude and frequency intimately connected with the phenomenon which brought them about, will furnish the means for establishing their cause and variation. Thus are measured the *emotional* reflexes—to adopt a convenient term—or, in other words, the coolness and self-command of a candidate.

For this purpose the examiner usually fires a revolver unexpectedly close to the face of the candidate, or lights a magnesium flare, or suddenly applies an ice-cold compress to his bare skin.

The records reproduced with this article show the enormous difference in the mental and physical temperament of good and bad candidates respectively.*

In the records relating to an indifferent candidate (Figs 5 and 6) the oscillations of the respiratory graph become disorganized and indicate great mental disturbance; they only resume their normal aspect after a while. The graph of capillary circulation shows that there was marked constriction induced by the vaso-motor nerves. The graph recording trembling shows accentuation of this action.

On the other hand, Fig. 7 relates to a good candidate. The alterations in the oscillations are slight and disappear almost immediately. Emotional balance is almost perfect. The candidate in question will probably meet a sudden danger without flinching or hesitation, act swiftly and to the point. He will become a good pilot and remain cool in the most critical circumstances.

As a matter of fact, theory in this matter is substantiated by practice. On comparing the graphs of our best-known star pilots Drs. Camus and Nepper have found that their psychomotive reactions are exceptionally quick and their degree of "emotionality" distinctly slight.

By a scientific method of selecting, therefore, these two physiologists have succeeded in establishing the fitness or otherwise of a candidate for the Air Services at the very inception of his career, and thereby avoid the loss of life and the risk of accident caused by too rigid adherence to a course of practical flying to determine whether a candidate be suitable or not. The point is that their method enables them to reject from the Air Services candidates who would never become efficient pilots or would at best, remain mediocre.

The method set forth above is not applied to candidates alone. It is most useful in determining the state of nerves which at times overcomes the best of pilots, and is known among the fraternity as "cold feet." After a period of rest some of these pilots have been proved by these means to have fully recovered their nerve; others have been found to have lost theirs definitely and have had to be drafted to other branches of the Army.

The French Navy is establishing a kindred method of medical examination for candidates for the Naval Air Service at Saint Raphael, on the Mediterranean. With regard to the question of the sense of equilibrium in connection with the same subject, it may be of interest to know that this is being tested by Dr. Lombard at the Laënnec Hospital by inducing voltaic vertigo applied successively to either ear.

The practical value of the system may be gauged from the fact that through its means from 25 per cent. to 30 per cent. of the candidates for the Air Services have been definitely rejected without further ado.

Note—The sense of balance, especially in the vertical dimension, is controlled by the semicircular canals of the inner ear. These canals are distributed in three rectangular planes and immersed in a fluid which moves and whose hydrostatic pressure varies, at the orifices of the canals, with any change of the position of the head through the three dimensions of space. The sense of balance is further controlled by the reaction of different parts of the body, through their inertia, to any acceleration to which they are submitted. Thus, variations in ascending, descending and speed set up epigastric contraction of the solar plexus which everyone experiences from time to time in ordinary life.

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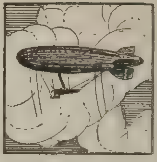
*Each part covers a session's work.

*The moment of the disturbance is marked by a cross.

MILITARY AEROSTATICS



Major Frank Purdy Lahm, Signal Corps, U. S. A., In Charge of U. S. Balloon School, Fort Omaha, Neb.

By Augustus Post

MAJOR FRANK PURDY LAHM, Signal Corps, U. S. A., one of the honorary members of the Aero Club of America and one of its early founders, is one of the very few who hold all three of the certificates issued by the Aero Club of America. These are for Dirigible and Spherical Balloon pilot and Aviation Certificate—the second to be issued by the Aero Club of America.

Major Lahm's father, Frank S. Lahm, also one of the founder members of the Aero Club, was for many years the Dean of air pilots of the Aero Club of France, and did more than any one else to bring to the attention of the world the marvelous achievements of the Wright Brothers at Dayton. He was a special commissioner of the Aero Club of France to investigate the claims of the Wright Brothers which he was successful in substantiating in every particular. He naturally initiated his son in the science of aeronautics at a very early period in their development, and it was while Major Lahm was stationed at West Point that the Aero Club of America arranged for the first balloon flight for its members, which through his kind assistance, was made there in February, 1906, immediately following the first aeronautical exposition held by the Aero Club of America in conjunction with the Automobile Club of America.

Since this very early beginning, in 1906, Major Lahm has been very active in developing aerostatics in America and was chosen to represent the Aero Club of America in the first Gordon Bennett International Balloon Race held in Paris, in 1906, which he won accompanied by Major Hersey, bringing the Gordon Bennett Trophy to the Aero Club of America. In commemoration of this event the Lahm Trophy was offered for competition by the Club to be awarded to the pilot making the longest flight to be made in America. This prize was finally won by Mr. Alan R. Hawley, president of the Aero Club of America, by his record flight from St. Louis to the wilds of Quebec, Canada, in 1910, covering a distance of 1,172 9/10 miles, and as he held this record for over three years, the trophy passed into his permanent posession. In September of 1908, Major Lahm, who was in charge of the aeronautical division of the Signal Corps of the U. S. Army, was selected by General James Allen, then chief signal officer U. S. A., to be trained by Mr. Orville Wright to operate the Wright machine, the first successful heavier-than-air flying machine to be purchased by any government for war purposes, and on September 9, 1908, immediately after Mr. Orville Wright had made his second world's record in the same day by a flight of one hour, two minutes, fifteen seconds. Not completely satisfied with the day's work, Mr. Wright had the machine brought back to the starting track and asked Major Lahm to accompany him. Major Lahm, just as he was with his boots and spurs on, dismounted from his horse and got into the small seat beside Aviator Wright. Both having taken their places, the motor was started, and for the fourth time that day the machine bore its burden aloft. This time it was longer in getting off, but rose after attaining its full speed and started circling the field at 6:42 P. M. It was getting dark and the moon was rising over the trees of Arlington Cemetery, but it was quite still, and the air was calm—six times and a half in six minutes, 24 seconds Mr. Wright and Major Lahm turned and sailed over the heads of the people. Mr. Wright asked Major Lahm how he liked it. "All right," he shouted, which was heard above the noise of the motor, "It beats the balloon." The aeroplane descended near the shed, landing lightly, and taking a little jump in the air before finally settling down as if it wanted to go on further. This is the history of the first passenger flight in America.

Major Lahm was then trained in the operation of the dirigible balloon which was built by Captain Thomas S. Baldwin for the U. S. Government, the first dirigible to be owned by the Army, and some time after this he was detailed to go to France to study the breeding of horses at "Samur," the French cavalry school.

Subsequently he was returned to aviation duty and was stationed in the Philippines and at North Island, San Diego, where he was engaged in training military aviators and only recently was transferred to take charge of the United States Balloon School at Fort Omaha, Neb.

77 Balloon Pilots

The Aero Club of America has just issued the following balloon pilots' certificates:

From Fort Omaha, Neb., U. S. Balloon School—No. 66, 1st Lt. Tolbert F. Hardin; No. 67, Capt. Max C. Fleischmann; No. 77, 1st Lt. F. A. Post.

From the Missouri Aeronautical Reserve Balloon School—No. 68, R. L. Sparks; No. 69, Roderick H. Tait, Jr.; No. 70, R. S. Tait; No. 71, John H. McCowley; No. 72, Jules Monti; No. 73, F. Rozier Wickard; No. 74, Fred M. Murphy; No. 75, E. A. Henshe; No. 76, Carl S. Attater.

Major Frank Purdy Lahm

The complete list of the balloon pilots who have received the F. A. I. certificate from the Aero Club of America are:

1. J. C. McCoy
2. A. Leo Stevens
3. Frank S. Lahm
4. Lieut. Frank P. Lahm, U. S. A.
5. Carl E. Myers
6. Henry B. Hersey
7. Alan R. Hawley
8. Capt. Charles de F. Chandler, U.S.A.
9. Thomas S. Baldwin
10. Albert C. Triaca
11. A. Holland Forbes
12. Charles J. Glidden
14. Nason Henry Arnold
15. J. H. Wade, Jr.
16. A. H. Morgan
17. Charles Walsh
18. A. B. Lambert
19. Charles Levee
20. H. E. Honeywell
21. G. L. Bumbaugh
22. Dr. R. M. Randall
23. Carl G. Fisher
24. John Berry
25. Wm. F. Whitehouse
*26. Edgar W. Mix
*27. S. Louis von Phul
28. Clifford B. Harmon
29. James Bemis
30. Henry H. Clayton
31. Roy A. Knabenshue
32. George B. Harrison
33. Jay B. Benton
34. J. Walter Flagg
35. Wm. T. Assmann
*36. Arthur T. Atherholt
37. William Van Sleet
38. Dr. L. E. Custer
39. E. S. Cole
40. Horace B. Wild
*41. Frank M. Jacobs
42. Albert Holz
43. Samuel Reber
44. J. J. Van Valkenburg
45. Paul J. McCullough
46. John Watts
47. Roy F. Donaldson
48. Ralph H. Upson
49. R. A. D. Preston
50. Warren Rasor
51. Robert Glendinning
52. Jerome Kingsbury
53. Raffe Emerson
54. Lt. Comdr. F. R. McCrary, U. S. N.
55. Lt. L. H. Maxfield, U. S. N.
56. Lewis C. Davidson
57. Capt. Hugh J. McElgin
58. Capt. James Prentice
59. Capt. H. R. Vaughan
60. Capt. H. LeR. Muller
61. 1st Lt. John H. Jouett
62. Capt. D. H. Bower
63. 1st Lt. B. B. Daggett
64. 1st Lt. Frank Goodale
65. 1st Lt. Arthur Boettcher
66. 1st Lt. Golbert F. Hardin
67. Capt. Mac C. Fleischmann
68. R. L. Sparks
69. Roderick H. Tait, Jr.
70. R. S. Tait
71. John H. McCowley
72. Jules Monti
73. F. Rozier Wickard
74. Fred M. Murphy
75. E. A. Henshe
76. Karl S. Attater
77. Lieut. F. A. Post

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*Deceased.

A Goodyear Kite Balloon some months ago, purchased by a committee of patriotic people of which Mrs. Charles E. Van Rensselaer was chairman, under the auspices of the Aero Club of America, has been transferred to the Missouri Aeronautical Reserve School and is being used to train students there

The volunteers who were to be trained with this kite balloon at the Staten Island camp are now being trained at the Missouri Aeronautical Reserve School and at the U. S. Balloon Station at Fort Omaha.

FOREIGN NEWS

FRANCE

Paris.—German aeroplanes made a raid on Paris at 11 o'clock on the evening of July 27. Two bombs were dropped on the capital. The opinion is held here that the raid was made with the object of testing the possibility of a successful German attack in force similar to the recent raid made on London.

A few minutes before 11 o'clock watchers of the French aviation service in Paris heard the noise of a motor and then an explosion, followed after a brief interval by another. The Prefecture of Police was accordingly instructed to give the alarm throughout the city. The last notification to the people of the capital to take refuge from a possible air raid was given on the night of March 16-17.

Soon after the warning of the raiders was given, the sky over the city was alive with defence aeroplanes twinkling like stars, from which they hardly could be distinguished. Firemen dashed through the streets sounding alarms on powerful sirens, and one by one the street lamps flickered out.

Residents of the city awakened from their sleep, instead of taking refuge in cellars, mounted to the roofs or went into the streets to watch the droning aeroplanes circling overhead. At 1:10 o'clock the firemen gave the signal that all danger was over and the Parisians returned to their beds, having seen nothing of the enemy.

Paris has been free from German air raids since January, 1916. On the 29th of that month the capital was visited by Zeppelins, which dropped about a dozen bombs, killing 24 persons and injuring 27. The raid at that time lasted about one minute and a half.

Paris, July 29.—A second German air raid aimed at Paris last night, following the "feeler" of the night before, proved wholly futile, the hostile fliers being dispersed by French sky fighters before they even reached the outskirts of the capital.

Somewhere on the front, however, one German flier dropped four bombs on a Red Cross hospital, killing two doctors, a chemist and a male nurse and injuring several others, including patients. The raider was flying low and the distinguishing marks of the hospital were plainly apparent.

Paris.—Bennett Moulter, an American aviator in the French service, has been injured, but not dangerously. He was pitched out of his machine while landing on the Belgian front after a night flight over the German lines.

Sergeant Andrew C. Campbell of the Lafayette Escadrille, a resident of Chicago, was formally notified that he had been awarded the French war cross in recognition of his bravery.

Coincidentally the French War Office announced the departure from the unit of Sergeant John Armstrong Drexel of Philadelphia, who will join the staff of Major Mitchell, the American officer in charge of aviation with Major-Gen. Pershing in Paris.

Despatches from the camp of the Lafayette Escadrille told of a stiff engagement which Corporal Robert L. Rockwell of Cincinnati had with an enemy biplane last week. Rockwell had flown over the enemy's rear lines with Capt. Thenault, Corporal Harold Willis of Boston and other fliers on a successful trip to make photographs of the enemy's situation.

One German machine hurried up and while Rockwell was fighting it eight other German patrol planes arrived. They did not offer to fight, however, and finally scurried away when the American fliers took the offensive.

Jean Navarre, a famous French airman, will go to America, hoping to be of some assistance to the American air service, according to information received by associates.

He probably will be accompanied by Georges Carpentier, the boxer-aviator.

GERMANY

Berlin, July 28.—German aeroplanes last night dropped bombs on the railway stations and military establishments in Paris. The official statement announcing the raid on the French capital says that all the German airmen returned.

Interesting comparisons of British, French and German methods of air-fighting were made recently by General Von Hoeppner, commander of the German flying forces, in an interview with the Berlin correspondent of the Holland News Bureau. General Von Hoeppner admitted that the air forces of the Entente Allies were superior on the western front and in the Balkans, but said that on the eastern front the German airmen outnumbered their adversaries. Mere superiority in numbers, however, he professed to believe, meant nothing when compared with the quality of machines and of the men flying them. He added:—

"The Frenchman is obviously not to be placed on a par with our airmen from the point of view of morale, but it is just in flying the Briton proves that he is of German race and therefore has a love of fighting. In general the Frenchman only attacks when he feels himself numerically superior. He avoids a fight under equal conditions. The Briton seeks the combat. The Frenchman only attacks once; if the first attack be unsuccessful, he immediately retires. The Englishman, on the other hand, fights till he or his opponent goes under.

"In their Spad aeroplanes of 200 horsepower and the British Sopwith triplanes they possess splendid machines, which mostly equal our best machines.

"More important, however, than the superiority of the machines is that of the crews. The enemy battle airmen are just as much up to their jobs as ours. That is not so, however, with the reconnoitering airmen. In the case of the French, their training, which should be of a purely military character, is mediocre, while with the British it is even inferior. Here are to be found the deeper causes of the better performances of our flyers.

"To Britishers flying is a sport, the climax whereof is a fight. They seek the combat regardless of the question whether the carrying out of the charge entrusted to them renders this necessary or not. The German is, first of all, a soldier, who looks upon every flight as a military operation, and that decides his line of conduct. Our proportionately smaller losses, therefore, show that our commanders are too good soldiers to set their airmen impossible tasks. Moreover, the airmen are not sent out singly, for the fulfilment of military tasks is more important than all spirit of sport and all bravery. The century old German military tradition cannot be caught up by the three years' warfare of the British."

GREAT BRITAIN

London, July 27.—The number of deaths caused by the German air raid over London on July 7 totalled fifty-nine, according to an official revised list.

An official statement on July 7 reported 43 killed and 197 injured in the German aeroplane raid that day. Three German aeroplanes were brought down and seven other raiders were destroyed.

C. G. Grey, editor of the *Aeroplane,* comments on Gen. Squiers' prediction on an air invasion of Germany as follows:

"The proposed invasion of Germany by American aeroplanes announced by Gen. Squiers will be heartily welcomed by the European Allies. France and Britain can supply trained military aviators for all the Allied armies, but they cannot spare the aeroplanes for the invasion of Germany.

"America can train pilots for bombing raids very much quicker than she can train pilots and observers in the special way needed for military work. Also America can built big bombing aeroplanes and the comparaticely heavy engines needed for them much more easily than she can build the highly stressed and delicate engines and aeroplanes required for high speed, reconnoisance and fighting.

"Therefore, the aerial bombardment of Germany pre-eminently is a task for America's air fleet. England possesses the most effective bombing aeroplanes in the world, and if the American aeronautical authorities are willing to learn from England's experience it should be an easy task for America to build such a fleet as would overwhelm any resistance the Germans can put up.

"British aircraft manufacturers and British aero engine makers are anxious to place their hardly earned knowledge at the disposal of America if permitted to do so unreservedly by the British aeronautical authorities. The American manufacturers of aeroplanes must be free to choose their own design of British origin and must not be restricted in choice by official control on either side of the Atlantic."

On July 29, a report from British headquarters in France tells of air raids resulting in bombs being dropped on a German airdrome, two important railway stations and an ammunition depot, where fires and an explosion were caused. Six German machines were forced down and six British are missing, including four lost in a storm.

An earlier announcement revealed that the activity of the planes had been directed against the works at Bruges and in areas throughout Middelkerke and Ghistelles. Several tons of explosives were dropped. The bombing continued until 10 o'clock in the morning, when a severe thunderstorm prevented further flying.

The ountput of aircraft in Great Britain is considerably on the increase, according to Dr. Addison, Minister of Munitions. He stated that since last January, when the Ministry became responsible to the Flying Service for supply, the programme had been steadily and largely increased. It was still expending and no limit could be set to it until the country had enough aeroplanes and seaplanes both for attack and defense. Dr. Addison said:

"No fewer than 100 factories are engaged on some process or other connected with the construction and equipment of the flying machine. Output is increasing by leaps and bounds. If for the purpose of comparison you put the number of aeroplanes produced in May, 1916, at 100, then in May of this year the number rose to rather more than 300.

"Even this rate of increase is being accelerated. The output in December will be twice what it was in April and the December total will be far surpassed in succeeding months.

"The number of aeroplane engines turned out monthly has been more than doubled this year already, and this total will be doubled again before the close of the year.

"A growing number of workers are employed in the aeroplane factories, the increase in the last five months being 25 per cent on the previous total. To meet the demand for labor special schools have been started all over the country, where a training of about two months qualifies a pupil to carry out some simple process in aeroplane manufacture.

"The variety of materials used in aeroplane manufacture has been a source of anxiety and the needs of the aeroplane enormous, almost passing belief.

"More spruce is wanted than the present annual output of the United States, more mahogany than Honduras can supply. All the linen of the type made in Ireland and the whole of the alloyed steel produced in England can be used, and to meet the needs of the air service for flax the Government had actually to provide the seed from which to grow the plant essential for its purpose.

"Lastly, special difficulties have to be overcome. Speed, climbing power and armament have continually increased and improved.

"Where there is no finality there is a limit of standardization except in small details, and the problem of supervising the manufacture of our aeroplanes is correspondingly complicated."

ITALY

Rome.—The American army mission concluded its visit in Italy on July 27 and left for Paris with expressions of admiration particularly for Italy's progress in aviation, of which a special study was made.

The American officers visited all Italian aviation centres and the Carnia, Cadore and Julian fronts, being warmly received by the King and the Duke of Aosta.

Brig.-Gen. George O. Squier, American army chief signal officer, is quoted by the Washington correspondent of the *Messagero* in an interview as saying:

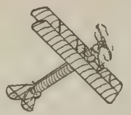
"Americans will gladly participate in the air war on the Italian front by sending aviators to join Italy's fleet, wearing the American uniform. We will likewise welcome Italian instructions to hasten the training of our airmen."

Gen. Squier expressed special admiration for the big Caproni triple-motored triplanes and the Italian pursuit planes.

Both the army and civilians are enthused over the report that the United States Government proposes to send aviators to the Italian front. King Victor Emanuel sought information on this subject from the American mission while here and the American Embassy has taken up the matter.

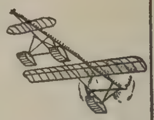
RUSSIA

Petrograd, July 28.—German aeroplanes made a flight over the railway station at Molodechna (northwest of Minsk), dropping five bombs upon the hospital camp near the station. A physician was killed and a nurse, priest and a boy were wounded.



MODEL NEWS

Edited by G. A. Cavanagh



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c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Flying Kites to Study Weather

(*Continued from page* 684)

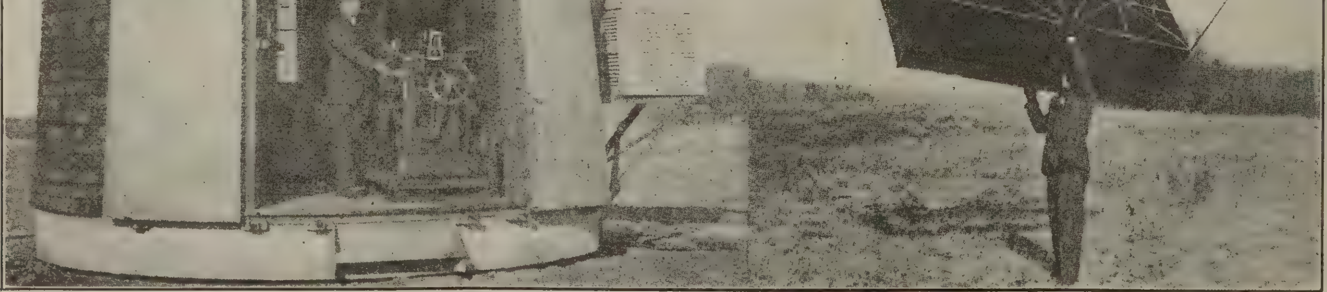
Since they fly two or three miles high and as many as ten or twelve may be fastened on the same wire, the convenience of the reel is easily apparent. Fine piano wire is used to fly the kites. Whenever it is desired to send them up the reel house is turned so that the entrance is on the leeward side of the house and the wire is then unreeled out of the door.

The first kite on the wire bears a little instrument called a meteorograph, which is fitted to one of the braces inside the kite. It is this instrument which records conditions in the upper atmosphere. It runs by clockwork in much the same way as larger instruments of the kind and with four delicate steel fountain-pens marks on a sheet of cross-section paper the wind velocity, temperature, barometric pressure and humidity for the entire time that a kite is in the air. Often the operator may desire to know how high his kite is flying. This he does by means of a theodolite, resembling the surveyor's instrument. He figures out the angle of the kite string and then from the amount of wire out, as registered by the reel, he computes the vertical distance of the kite above the ground. Besides the first kite carrying meteorograph, other kites are attached to the wire at intervals, the number depending on the wind velocity and length of line. Their purpose is to support the wire.

Flying kites is not the pleasant pastime that might be supposed. To be an expert in this line requires, probably most of all, a good sporting instinct. A kite flight generally lasts about four hours and it is the plan of Mr. B. J. Sherry, who is actively in charge of the station, to make one flight every day that there is sufficient wind, regardless of the weather. Twice a month a thirty-six hour period is set aside, when nine flights are made continuously night and day. It is often very cold work; during one of these thirty-six hour periods the thermometer did not go above zero even in the day time. Consequently the sportmanship of the men may be sorely tried at times.

To prevent life at the station from becoming too monotonous the kites occasionally break away and go flying over the country, trailing the wire behind. That naturally would make serious trouble for telegraph companies if the kite wire became tangled up with their lines, and in order to minimize that possibility as far as possible, the station was located five miles from the nearest railroad. In case a trailing kite wire came in contact with a high tension wire serious consequences also might result, although the probability is that the kite wire would be burned in two immediately. To guard against all these dangers a party of men leave in an automobile as soon as it is known that the kites are loose. On one such occasion recently, when the wind increased suddenly during a flight, the pull on the line reached 400 pounds. The kite wire, which is but little larger than 1-32 of an inch in diameter, broke, allowing a number of kites with several miles of wire to float across the country. The men left at 4 o'clock in the

(*To be continued.*)



Reel house for flying the weather kites. Mounted on a turn-table, it faces in any direction. Landing a kite. The double coloring makes it equally visible against dark clouds and light.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Now that the American eagle is devoting more time to flying than to screaming, it will inspire more cordiality on the part of the Gallic cock, the British lion, the Russian bear, etc.

When peace is declared, the enforced development of flight will not be the least valuable by-product of the war.

Historians may differ as to the precise moment that Woodrow Wilson decided war with the Teutonic Autocracy was a national necessity but they will all agree that in aligning a majority of our 100,000,000 people behind him in the defense of the liberty of the World, he has eclipsed every other individual accomplishment in the history of the World.

Flying a five-cent flag is no indication of one's flying aptitude.

Nature has always contrived to put bills in their happiest position,—duck's for instance. But when the position of a "Bill" is determined by man the results are sometimes ludicrous,—for instance Chicago's "Bill" (Thompson) at the head, unlike a duck's bill, is diametrically wrong.

Men afflicted with a "streak of yellow" balanced by a comprehensive intelligence, should learn to fly. The only positive antidote for expensive and fatal recklessness, is an intelligent "Yellow Streak."

Flying is not the only vocation that forces people "up in the air."

It seems that our national ideal is trying for the altitude record.

We were recently exhorting our pupils to take "Mental Flights" as an aid to the development of the flying instinct, but were disconcerted by a witty pupil submitting the query: "Could a feller make a safe landing from a mental flight during a brainstorm?"

One would think by the remarks of our leaders, aeronautic, that they were already "up in the air."

Replying to P. Knutt, the Goose Step is not a necessary introduction to flight.

Pupil: "Why the exuberant delight, Mr. Beech?"
We: "The man who has been collecting for our gasoline, with a piece of lead pipe for the last two years, has just signed up to learn to fly with us."

A. C. Beech.

A State Secret

It was getting very late, and the Irish-American, and the German-American were finishing their war argument in the back room of a cafe. As a final thrust, the German brought out a clipping telling of the great raid that the Germans had made over London. Nothing daunted the Irishman replied, "Shure, and that's nothin'. You could bring down the whole Royal Flying Corps, but you still would have the Irish Flying Corps to battle, and then Lord Help you!" The German was taken aback a moment, but then his face lighted up. "G'wan," he said, "who ever heard of the Irish Flying Corps. Why you don't even know where it is yourself!"

The Irishman saw that he was outpointed. Suddenly he turned to the German.

"You big dutchman, you don't think I would tell *you* where it is do you?"

Some Popular Beliefs of the Aeroplane

1. Aeroplane wings are covered with canvas.
2. If the motor stops, it is sure death to the occupants.
3. There is some gas concealed somewhere, or the thing couldn't fly.
4. Zeppelin invented the aeroplane.
5. To be pronounced correctly, the word should be spelled "A-r-e-o-p-l-a-n-e."

Wish vs. Back

Over the recruiting booth of the Canadian Irish Rangers in Dominion Square, Montreal, last winter was the motto:

"If your wishbone is where your backbone ought to be,
WISH for peace.
"If your backbone is where your backbone ought to be,
FIGHT for peace."

A Chance for Publicity

We have decided that we will print the very next contribution that comes into this office, no matter how good or how bad it may be. So if you feel a funny streak coming on you, take out your Waterman, scribble it off and send it in. We will sign your name to it and everything.

Yours truly A. Rookie
P.S. I made an ascension with the observation balloon yesterday. It's quite exciting
P.P.S. There is no truth in those stories about shoddy uniforms; the pants are especially strong! Amos

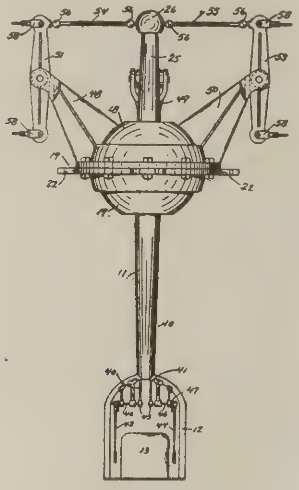
GET OFF THAT HOOK YOU BIG BOOB!

Courtesy N. Y. Herald

RECENT AERO PATENTS

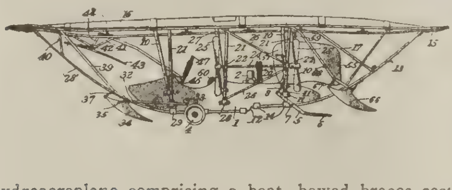
BY WILLIAM N. MOORE

1,173,977. STABILIZER. Grover C. Johnson, Buffalo, N. Y. Filed Apr. 15, 1915 Serial No. 21,510. (Cl. 244—29.)



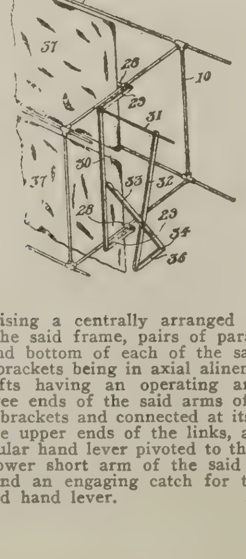
1. A stabilizer for air ships comprising, a pendulum, an operator's seat secured to the lower end of said pendulum, a stem controllable by said pendulum and extending upwardly above it, means connected with said stem for controlling the side and rear guiding means of the air ship, and means controlled by the operator for moving said stem in any desired positon, whereby the path of travel of the air ship may be governed.

1,156,218. HYDROAEROPLANE. Robert Charles Edwards, Cannelton, Ind., assignor of one-half to Otto Kniesche, Tell City, Ind. Filed Oct. 1, 1914. Serial No. 864,469. (Cl. 244—2.)



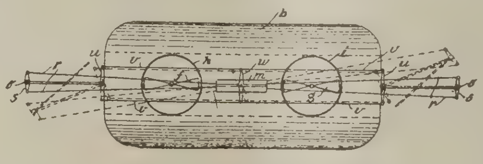
1. A hydroaeroplane comprising a boat, bowed braces secured longitudinally to the bottom thereof, planes secured to the upper ends of said braces, resilient cross bars fastened to said bowed braces and projecting beyond the opposite sides of the car, and floats rigidly secured to the ends of said resilient bars.

1,173,543. AEROPLANE. Jan Teczo, Passaic, N. J. Filed Sept. 28, 1915. Serial No. 53,054. (Cl. 244—12.)



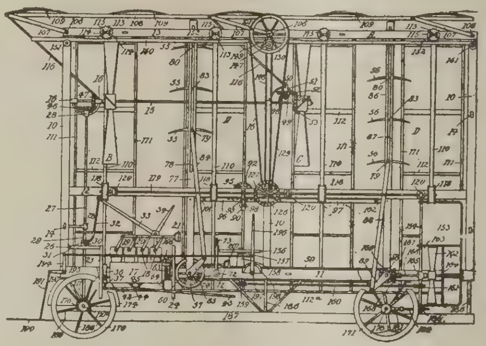
An aeroplane comprising a centrally arranged frame, side brackets oppositely carried by the said frame, pairs of parallel shafts journaled centrally of the top and bottom of each of the said brackets, the said shafts of the separate brackets being in axial alinement with each other, each of the said shafts having an operating arm, connecting links pivoted between the free ends of the said arms of each bracket, a rod extending between the brackets and connected at its ends to the joint of the upper arms and the upper ends of the links, a toothed rack within the said frame, an angular hand lever pivoted to the said rack, a pivoted lever connecting the lower short arm of the said hand lever with the said connecting rod, and an engaging catch for the teeth of the said rack carried by the said hand lever.

1,156,514. STEERING APPARATUS FOR AIRSHIPS. Louis C. Badeau, New York, N. Y. Filed Jan. 3, 1910. Serial No. 536,024. (Cl. 244—10.)



1. A machine for aerial navigation having a longitudinal propeller-tube open at its ends, propelling means therein, a vertical rudder at one end of the propeller-tube, a vertical pivot supporting said rudder, and means for materially displacing said pivot in a direction sidewise of the pivot and of the machine and for swinging the rudder in the opposite direction about the axis of the pivot so as to dispose the rudder diagonally across the end of the tube.

1,137,533. FLYING MACHINE. Hermann Reiche, Millstone, N. J. Filed Nov. 10, 1909. Serial No. 527,155. (Cl. 244—12.)



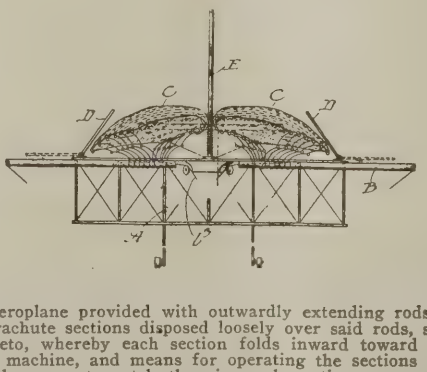
1. A flying machine provided with a front propeller, a series of lifting planes located back thereof, a rear propeller rotating with a higher speed and in a direction opposite to that of the front propeller, a series of lifting planes located back of the rear propeller, and means for vertically reciprocating both series of planes.

2. In a flying machine, the combination of an air propeller and a series of coöperating reciprocative lifting planes located back thereof and inclined relatively to the current produced by said propeller, and means for varying the course of said planes.

3. In a flying machine, the combination of an air propeller, a guide located back thereof, reciprocative lifting planes engaging said guide and inclined relatively to the air current produced by the propeller, and means for varying the inclination of the guide.

4. A flying machine comprising a frame, a propeller, a guide fulcrumed to the frame, reciprocatve lifting planes engaging said guide and inclined relatively to the air current produced by the propeller and means for tilting the guide.

1,143,643. SAFETY APPLIANCE FOR FLYING-MACHINES. Jacob Messikommer, Chicago, Ill. Filed Mar. 16, 1914. Serial No. 824,981. (Cl. 244—21.)



1. An aeroplane provided with outwardly extending rods at the top thereof, parachute sections disposed loosely over said rods, slidably connected thereto, whereby each section folds inward toward the vertical axis of the machine, and means for operating the sections on the rods to spread the same to catch the air, each section constructed to bag upward, said rods arranged in pairs, and each parachute section having its opposite edges connected respectively with the members of a pair, which members are disposed a distance apart less than the width of the section allotted thereto.

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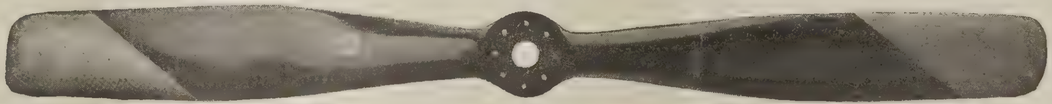

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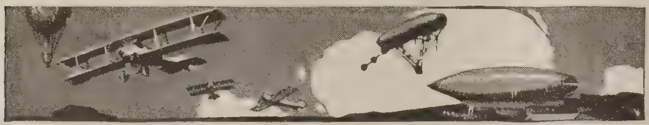

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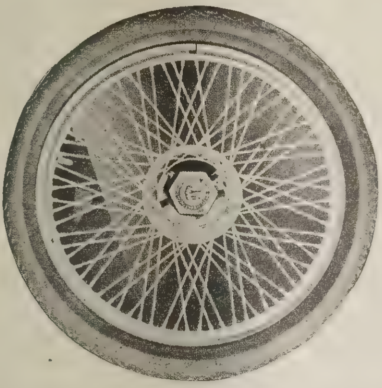

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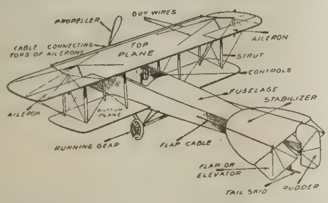

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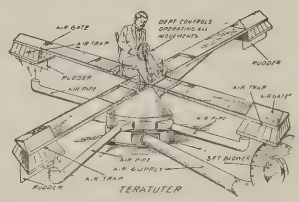

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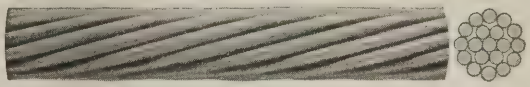

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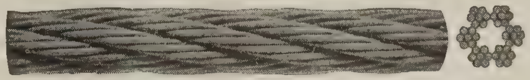

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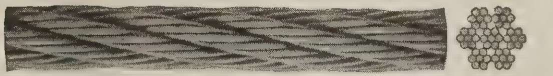

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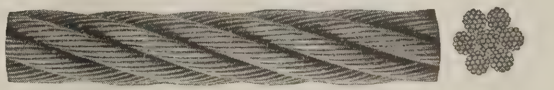

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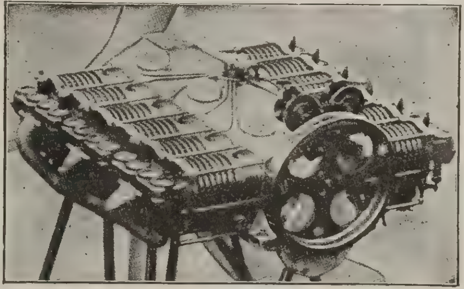

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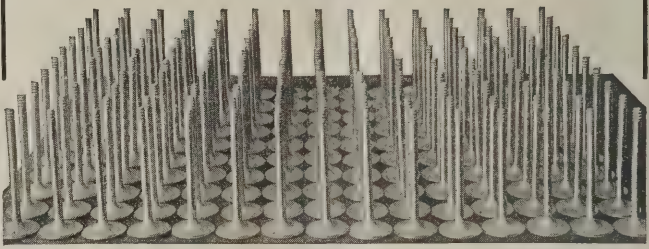

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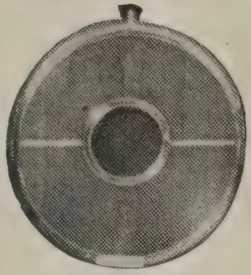

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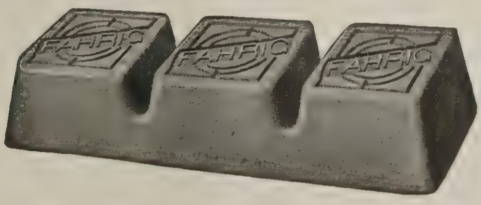

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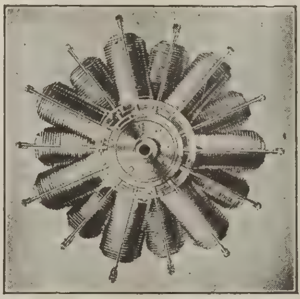

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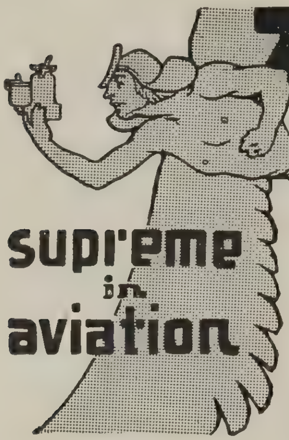

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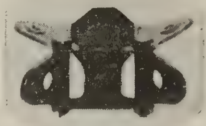

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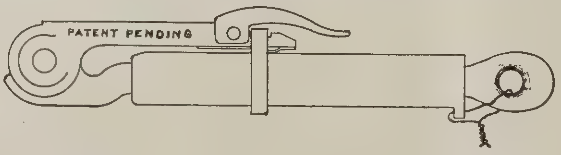

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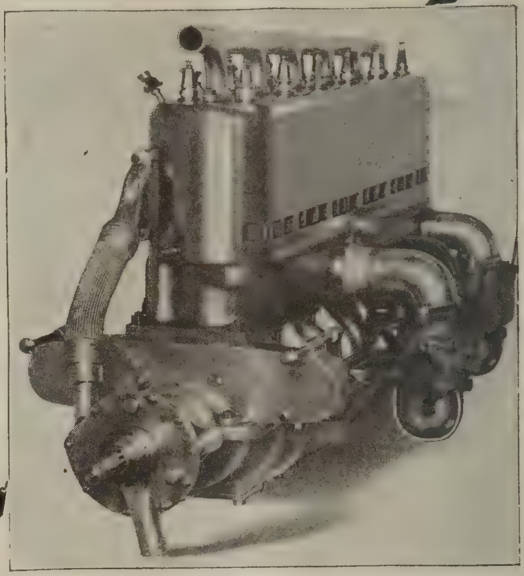

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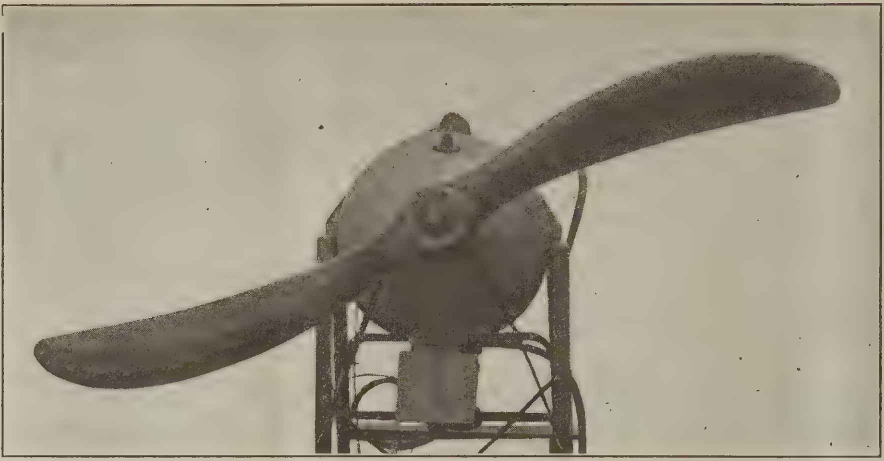

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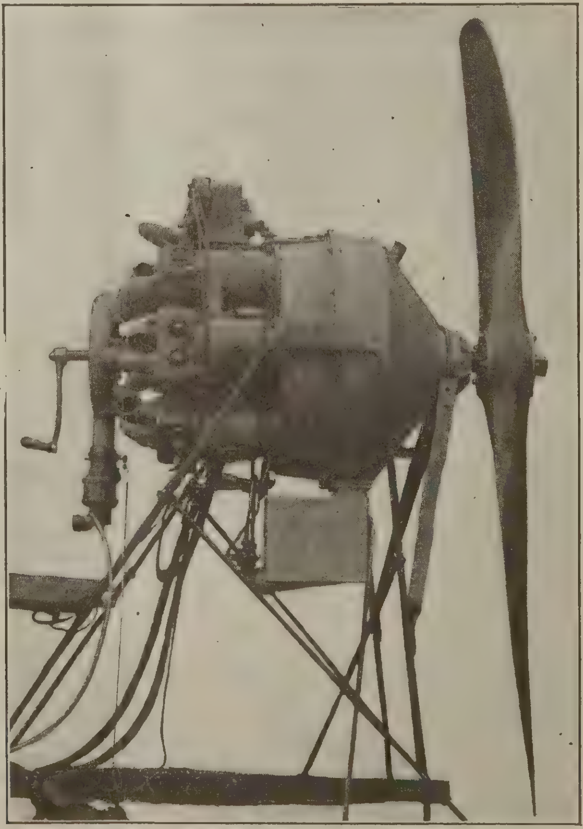

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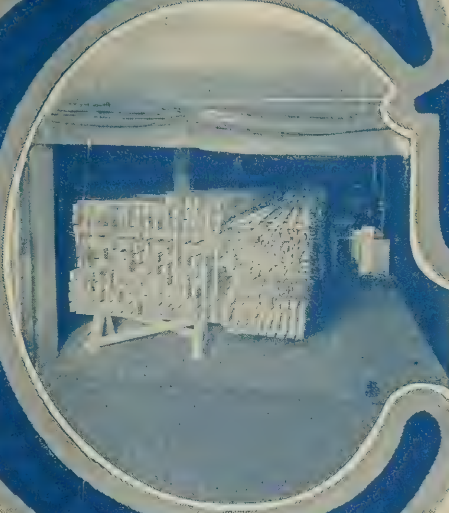

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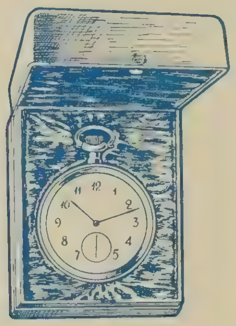
AEROL

A practical quality oil for aeroplane motors



There are all kinds of watches—from a dollar up. There are watches built to stand hard, rough usage. There are very fine watches built for extreme accuracy and dependability.

* * *

There are all kinds of gasolene motors; from a one-cylinder farm motor to the finest aeroplane engine.

* * *

Because of its very fineness, a good watch is easier to keep running accurately than a poor one.

Likewise, an aeroplane engine is many times more dependable than its cheaper brother.

* * *

The lubrication of an aeroplane motor, because of its very fineness, should be less of a problem than the lubrication of an automobile motor.

THE problem of aeroplane motor lubrication, resolved into its simplest terms, is this:

"To lubricate an exceptionally fine motor operating continuously under maximum load."

Hence, we have produced *AEROL*—not an oil of mystery—but a practical quality lubricant based on conditions to be met (except for rotary motors).

AEROL is, first of all, a very high grade oil, free from impurities.

Its lubricating values are very high, because it is an exceptionally good oil, made from a good crude to begin with, by a process developed through years of knowing how.

The drop in viscosity with the increase in heat is (relatively) unusually small. It is made in three grades of viscosity to meet the requirements of different types of motors.

AEROL is a practical oil because it is easily handled and flows easily. This feature is of practical utility where oil is drained off and cleaned out frequently. Also, where external feed systems are used.

Full details, characteristics and tests will be furnished to government officials, aeroplane manufacturers or others interested in the subject of aeroplane motor lubrication.

Technical and Research Department

SWAN & FINCH
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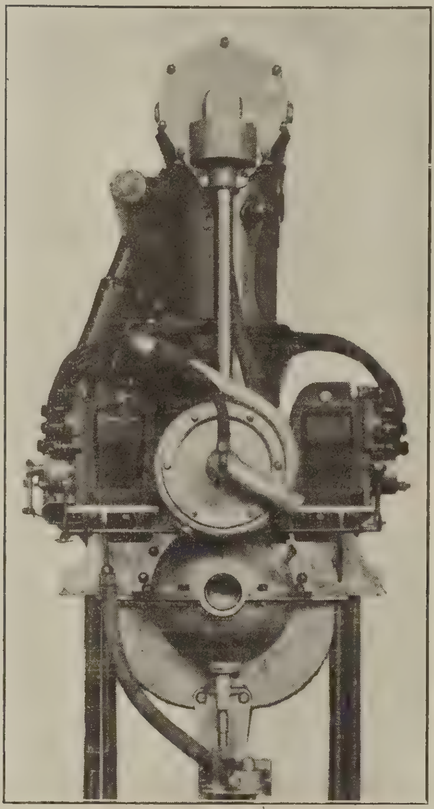
120 H. P.

SIX



Extracts from Army and Navy Report

"The engine performed a very satisfactory endurance test. Observations throughout the test showed that the vibrations were low, quick acceleration and good carburetion maintained, also the absence of oil leakage was another good feature as well as no evidence of water leakage at any of the joints."

"The engine demonstrated that its design and construction was such that it would stand endurance test of a much longer duration as when the run was stopped the engine was functioning very satisfactorily."

"The inspection of the engine after the 48-hour endurance test showed the fundamental design to be such that satisfactory service would be given by this power plant. The quality of the workmanship throughout was of a very high order, and also that the very best of material had been used throughout the engine."

UNION GAS ENGINE CO.

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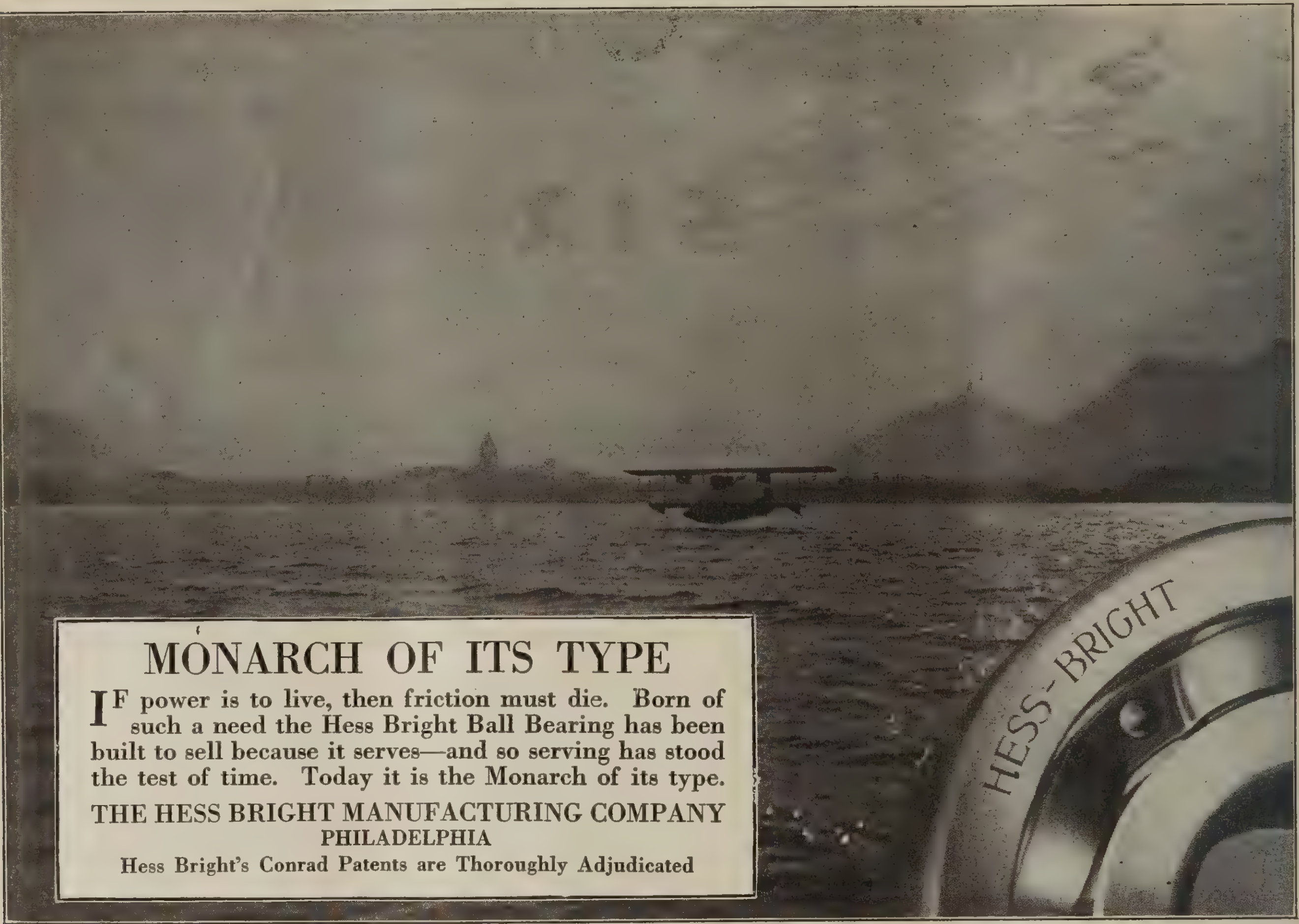

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Hess Bright's Conrad Patents are Thoroughly Adjudicated

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Dependable Aircraft Motors

An efficient, dependable aircraft power plant that offers many distinct advantages to the aeroplane constructor and the aviation school. Possesses those three necessary qualities in an aircraft motor—Reliability, Dependability and Power. The ideal motor for training schools.

Roberts Model 6X, Aircraft Motor—100 h. p.

Specifications:—Two cycle, Water Cooled, Six Cylinder, cast en bloc. Valveless and Gearless. 5" bore, 5½" stroke. Absolutely simple in construction. Two Miller Carburetors. Two High Tension Magnetos. Aluminum Base. Drop forged hollow Crank Shaft. Ample sized die cast bearings. Lubrication simple and positive in action. Normal speed 1200 R.P.M. Weight approximately 368 pounds. The Roberts Patented Cellular By-Pass absolutely prevents back-firing. A high grade motor at a medium price.

Write for Full Descriptions, Blue Prints, Prices.

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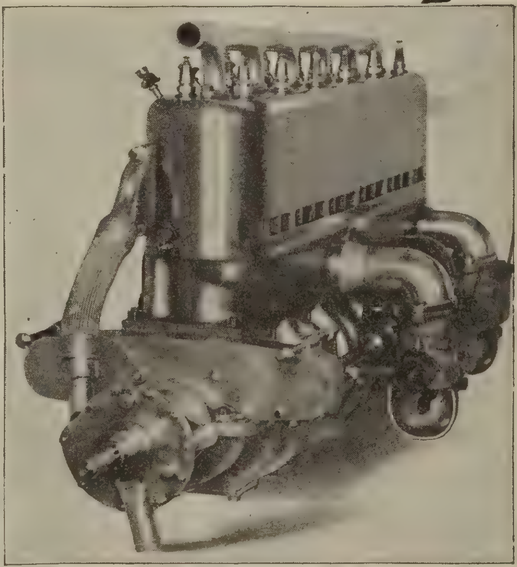

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Constructors can greatly simplify the complex problems of landing gear design by the adoption of rigid axles with ACKERMAN WHEELS and at the same time insure a better landing support for the airplane.

The spring action of the wheel absorbs all shock before it reaches the axle, prevents rebound and makes

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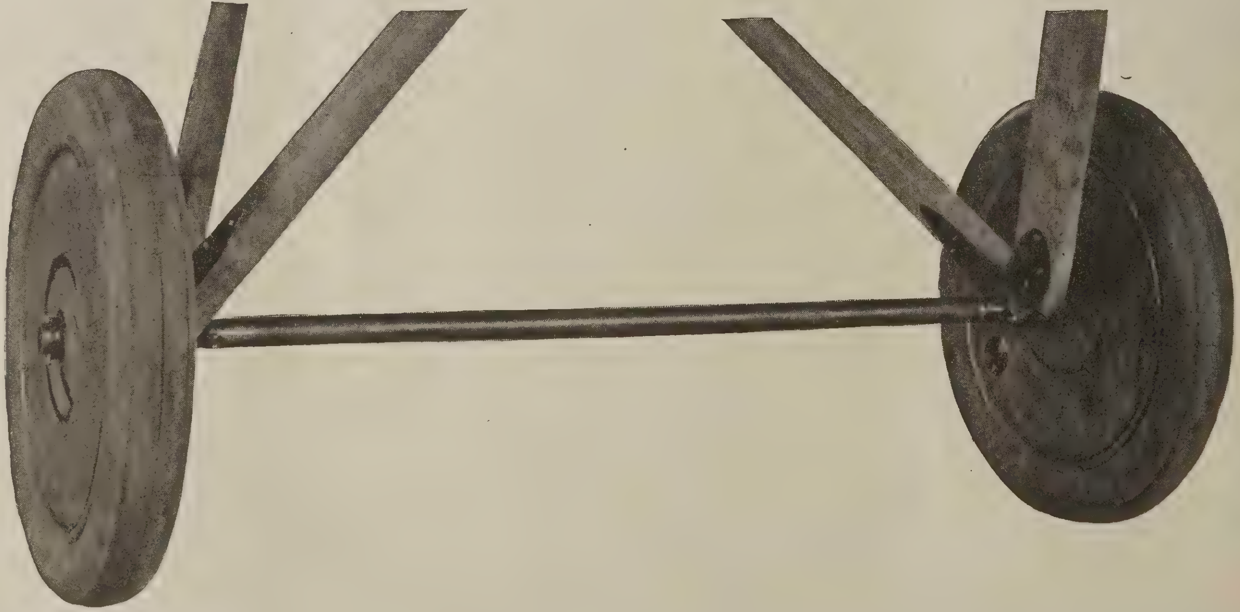
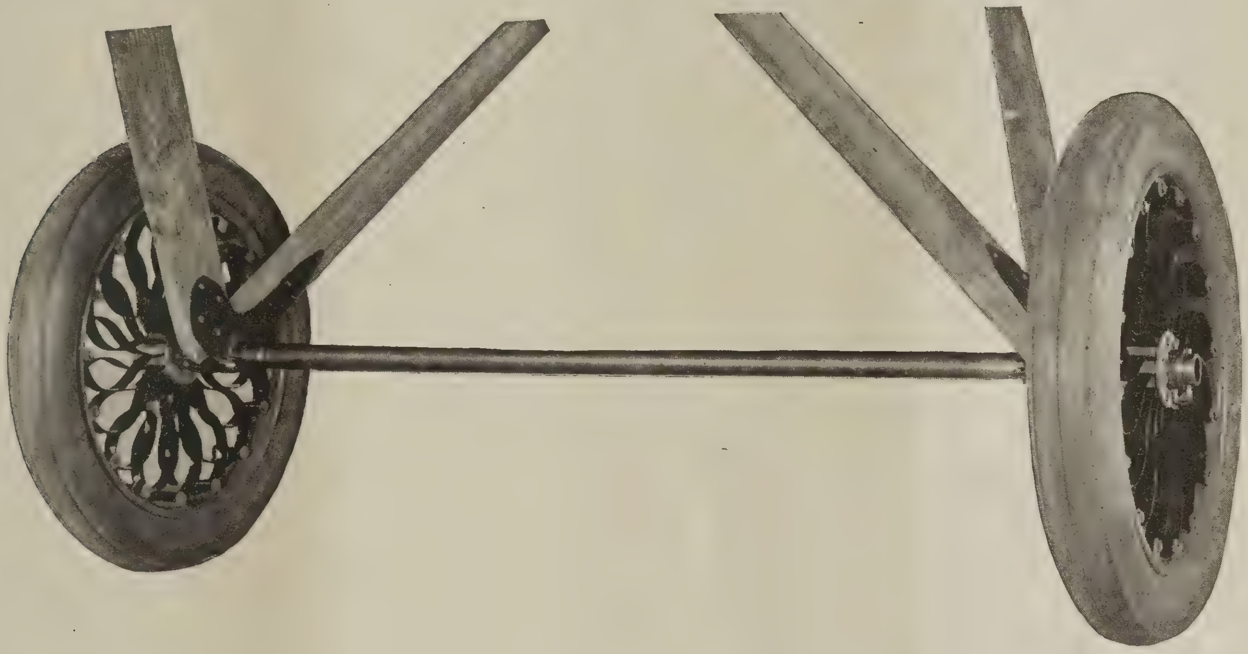


THE MODERN AEROPLANE



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AMERICA ASKED TO ACT QUICKLY IN PRODUCING AEROPLANES AND TRAINING AVIATORS

30,000 Aeroplanes and 60,000 Motors Required to Keep 5,000 Aeroplanes in Commission

IN a remarkable statement, printed in the New York *Sun*, M. Flandin, head of the Allied Air Board, urges America to act quickly in producing aeroplanes and training aviators. The war will be won in the air: America can contribute most effectively to this end, but she must act quickly; no time should be lost in sending the maximum number of aeroplanes and aviators.

M. Flandin's statement follows:

"You must bear in mind that the average life of an aeroplane on the battlefront is not more than two months. Therefore in order to keep 5,000 machines in active commission for one year it is necessary to furnish 30,000. Each machine, in the period of its activity, will use at least two motors, so that 60,000 motors will be required.

"These motors must be constructed, tested and prepared for service two months in advance of the time when they will be assembled with the aeroplanes, which means that the entire output will have to be turned out in ten months.

"The immensity of a programme calling for the construction, as has been suggested, of 100,000 aeroplanes would stagger any country not possessing the great industrial resources of the United States. America's contribution may be divided into material and personnel.

Standardized Machines

"The aeroplanes should be constructed entirely in the United States, and as many as possible built on standardized plans, so that the parts will be interchangeable. The machines then should be dismounted and shipped to France, to be reassembled here by the Aviation Service Corps, which will be part of the American expeditionary force.

"This is necessary for the reason that France needs all her skilled workmen in other lines and also because it would not be wise, owing to labor conditions, to bring American civilian machinists here to do the work in question. The labor problem in France is very serious in this connection, and the United States could do much to alleviate the situation.

"We have thousands of automobile men doing transport work and hundreds of factories are building motor trucks. If the United States, with its large number of plants, would build these cars and send them here with men to run them, it would enable us to divert our skilled workmen from these factories and manufacture motors for the aeroplanes which America will supply, for I am convinced that for the present, at least, American aeroplanes should have French built motors.

"We have experimented continuously for the last three years and are now producing motors equal to the severe demands which the aerial warfare of to-day makes. There are many factories where these motors could be built, but at present they are making automobiles. We have the machinery and the skilled workmen: we can produce the motors more rapidly and to a greater degree of perfection than would be the case were it necessary to build and equip new plants.

Field for College Men

"An idea of the number of men required behind the lines for the maintenance of an aerial army may be gained from the statistics of our department of aviation, which calculates that 30,000 men are needed for every 1,000 aeroplanes at the front.

"As to personnel, I have the greatest confidence that the alert and quick witted pilots that the United States will send us will have in a high degree the initiative and resourcefulness which are vital to the aviator. These qualities are nowhere better developed than in the young manhood of America. The air service should appeal to young college men, especially those who have taken an active part in athletics.

"These aviators should receive the greater part of their training before coming to France. All details of handling the planes should be learned there. When they arrive here they would be ready to receive instruction in battle tactics, observation work, artillery control and reconnaissance. French flying men of wide experience will impart their knowledge in special camps established for the purpose.

"The reason for preliminary training in the United States is obvious; we cannot spare many of our airmen as instructors, we need them at the front."

In closing his statement, M. Flandin said impressivley:

"Again let me emphasize the importance of quick action. The sooner the United States gets machines and men to France the greater will be her contribution to the cause of civilization and the sooner the war will end."

As illustrating M. Flandin's remarks about the training of a flying army, it is interesting to note that at one school where 100 pilots are receiving instructions 75,000 gallons of gasolene and 10,000 gallons of castor oil are used monthly.

THEODORE ROOSEVELT ENDORSES AERO CLUB'S EXCELLENT WORK

IN a characteristically spirited letter Col. Theodore Roosevelt endorsed the excellent work of the Aero Club of America in its campaign for a large air fleet. The Colonel's interest in aeronautics dates back to 1897, when, as Assistant Secretary of the Navy, he recommended to President McKinley that the Government give support to Mr. Langley in his aeronautic experiments; and again, in 1907, when, as President of the United States, he approved the ordering by the Army of the first aeroplane and first dirigible. His letter follows:

"I heartily congratulate the Aero Club of America on its efforts to secure a great aerial government program here in America. It should be one of the most important features in that work of adequate preparedness in advance which depends for its success primarily upon the adoption of the principle of universal obligatory military training for all our young men. I believe that the peculiar American characteristics especially fit us for success in developing and using the aeroplane on land, and the hydroaeroplane on sea; yet this country, which gave birth to aviation, has so far lagged behind that now, three years after the great war began, and six months after we were dragged into it, we still have not a single machine competent to fight the war machines of our enemies. We have to trust entirely to the machines of our Allies. I am not prepared to speak as to the sufficiency of aeroplanes to do some of the tasks which you have in view; but that they will be a very great factor in the accomplishment of these tasks, I am sure. As you well say, this should be the fifth arm of our Army; and it should be made a long reaching weapon, to use effectively, if conditions at any time arise that will enable it to strike the deciding blow.

"It may be utterly impossible to strike that blow without a thoroughly effective air force, and it is utterly impossible to improvise such a force. It has been unpardonable folly on our part as a nation that for three years, with this great war staring us in the face, we have absolutely failed to prepare for it, and our folly has been at least as marked as regards aviation as in any other field. No one can tell how long this war will last. If we are true to ourselves, we will make it last just as long as is necessary in order to secure the complete overthrow of the Prussianized-Germany of the Hohenzollerns. Therefore, we should at once begin to prepare on the largest scale for warfare in the air, as one of the great features of the warfare of the future.

"In all probability such preparation will be of the utmost consequence in this war. I am absolutely certain it will be of the utmost consequence in preventing us from being overwhelmed by disaster in some future war."

(Signed) THEODORE ROOSEVELT.

International Committee Formed to Standardize Aircraft Parts Will Hold First Meeting in New York

An International Committee has been formed to standardize aircraft metal parts which will hold its first meeting in New York on Wednesday, August 8th.

The purpose of the Committee, which includes representatives of the United States, France, Italy, Great Britain and Canada, is to endeavor to standardize the specifications for the metals which go into aeroplanes and the metal parts, so that production can be had on a large scale.

If this production on a large scale is to be obtained, it is essential to eliminate the loss of time and output and the additional cost involved in manufacturing many metals which are not now standards in the mills of the United States. It is also necessary to adjust the parts on all machines to a single standard as far as possible in order that production may be uninterrupted.

Mr. Frank G. Diffin, until recently the head of the Erie Specialty Company of Erie, Pa., who resigned from all connection with that company from patriotic motives so as to take charge of standardizing of aircraft metals and aircraft metal parts for the Army Air Service, has been selected as the American representative of this International Standardization Committee.

This Committee will have most important work to do. The average aeroplane has thousands of metal parts, one item alone being 248 turnbuckles. Heretofore bolts were made in innumerable sizes, the difference between which often was measured in a few thousands of an inch in length of diameter. For one specific kind of bolt, used for the same purpose on various types of machines, different manufacturers called for the use of six different metals and sixty different lengths, and eight different diameters, differing from each other only by this small fraction.

As a result, when the Army placed orders for 360 aeroplanes last fall, and needed them in a hurry, Mr. Diffin, then head of the Erie Specialty Company, and the only firm prepared to turn out aeroplane metal parts in quantities, was called upon to supply 3,800 different metal parts. He figured out that fully fifty percent of these different sizes were unnecessary and started out single-handed to make the manufacturers of aeroplanes agree on standardization, limiting the number of diameters and lengths to the smallest number possible.

He succeeded, and was able to treble the production of parts with the same amount of machinery and personnel.

Mr. Diffin also found that none of the manufacturers of machine screw parts were working in nickel steel and that it was necessary to expend a small fortune and considerable time in experimenting in the machining of this very difficult metal.

Believing in the potentiality of the aircraft, he foresaw that there would soon be a demand for thousands of aeroplanes, and that unless this problem was solved there would be delay in manufacturing the aeroplanes. He set to work and succeeded in evolving the tools and the methods of handling the steel, and solved the problem for his own company.

These are only some of the problems worked out by Mr. Diffin which have cleared the way for quantity production of aircraft parts when the United States suddenly decided on a large expansion of the Army Air Service.

Recently the authorities realized that the Armies and Navies of the Allied countries will need tens of thousands of aeroplanes of different types, and that steps should be taken to standardize metals and parts so that the United States could supply parts for all the countries.

Mr. Diffin's services were needed in Washington and the authorities asked whether he could undertake this patriotic work without impairing the aeroplane parts production of the Erie Specialty Company, which was working three shifts of workmen, using its machinery 24 hours each day.

Mr. Diffin had used his genius for standardizing in his own factory, had built a perfect organization, had mobilized the industries necessary for manufacturing of aeroplane parts in large quantities, and had trained the operators needed and mobilized the machinery for enormous and immediate expansion.

Realizing the importance of the work in Washington, he resigned his position with the Erie Specialty Company, sold his interest in that company, and went to Washington to take charge of the standardization of aircraft parts and metals. In this position he had charge of the specifications for all metal that goes into aeroplane parts and the inspection from the hot mill through the various stages, to the finished aeroplane parts.

He had called around him an advisory board of very able men who are experts in the manufacture of all the metals which are used in the manufacture of an aeroplane or an aeroplane motor. This Board includes the most practical men and the most scientific men in their various lines and consists as follows: F. G. Griffiths, Central Steel Company; H. L. Green, Wright Martin Aircraft Corp.; Dr. J. A. Mathews, Halcomb Steel Co.; K. W. Zimmerschied; H. J. Horn, John A. Roebling's Sons Co.; W. H. Bassett, American Brass Co.; C. M. Manley, Curtiss Aeroplane Co.

In the making of aeroplane parts it is essential to have maximum strength with minimum weight. Saving the fraction of an ounce from each of the 3,000 parts means increasing the useful load that can be carried, but safety is the most vital essential and the necessity for rigid inspection is evident. Some of Mr. Diffin's plans in this connection are almost revolutionary, but they are all designed to get both production and perfection of product.

Chairman Charles M. Manley's Substantial Work in Standardization

Mr. Charles M. Manley, the chairman of the Aeronautic Standard Committee of the S. A. F., has been doing substantial work in standardizing.

The Manley "steam roller" usually succeeds in travelling the road for reform in standardization, and the nation will be indebted to Mr. Manley and his committee for removing some of the obstacles that stand in the way of quantity production.

Air Board With Extended Power Approved by Secretaries Baker and Daniels

The bill to extend the power of the present Aircraft Production Board and provide for its maintenance, which was introduced in the House of Representatives by Congressman Murray Hulbert, and in the Senate by Senator Morris Sheppard, has been approved by Secretaries Baker and Daniels and has been endorsed by the Aero Club of America and the Aerial League of America.

The bill, as introduced, reads as follows:

A BILL

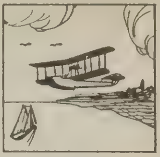
To create an Air Board and provide for its maintenance.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of expanding and coordinating the industrial activities relating to aircraft or parts of aircraft produced for any purpose in the United States and to facilitate generally the development of air service, a board is hereby created to be known as the Air Board, hereinafter referred to as the board.

The board shall be composed of the Chief Signal Officer of the Army, the Chief Constructor of the Navy, and not

(*Continued on page* 799)

THE NEWS OF THE WEEK



Reported That Navy Will Build Million Dollar Aeroplane Plant

Just as we are going to press the newspapers print the following statement from Hon. Josephus Daniels, Secretary of the Navy.

"In view of the enormous expansion of the aeroplane industry now being undertaken in the United States, it was felt it was necessary to increase the Navy Department's facilities along these lines, not only to enable it to supply a part at least of its own needs but in order that the private plants might be relieved of the experimental developments which they have hitherto undertaken and turn their whole attention to the maximum production of approved types.

"Contracts have been placed for the factory on the basis of completion of buildings and beginning of operation in less than 100 days. The total cost of the buildings and plant will be in the neighborhood of $1,000,000, and it is expected that when the completed plant is working up to its capacity it will utilize the services of approximately 2,000 employees and be capable of producing 1,000 small planes per annum, or a corresponding output of the larger types.

"The Navy Department has a small flying field at the League Island yard adjacent to the factory and excellent facilities for hydroplanes, so that it will be able to utilize this plant to keep the navy in the forefront with the latest developments in air craft."

Mr. William A. Morgan, the new General Manager of the Curtiss Companies.

William A. Morgan, New General Manager of the Curtiss Companies

William A. Morgan has become the vice-president and the general manager of the Curtiss Aeroplane and Motor Corporation. He had but recently retired from business on the sale of the Buffalo Copper and Brass Rolling Mill, which in less than three years he had made the largest mill of its kind in the United States, spending millions in new construction and increasing the working force from 300 men when he took charge to a force of more than 5,000 working day and night.

He is a business man of the new type, an idealist of the practical kind who has the courage of his imagination and vision. You sense the spirit of the man in his new tasks which he has taken up with energy and efficiency in this: "I had hoped to retire from active business but when the call came to help shorten this war through the building of aircraft, I knew that this patriotic duty could not be put aside by personal desire."

A young man yet for so many solid achievements, Mr. William A. Morgan has already become one of the best known philanthropists and business leaders in Buffalo. He was born in 1872 in Rochester and as a boy grew up in Michigan and Illinois. His first job, in 1885, was that of carrier for the old Chicago Inter-Ocean. He was a bookkeeper for a Chicago iron company in 1892 and the next year for Swift & Co. His promotions were rapid and some twelve years ago he came to Buffalo as the district manager for Swift & Co., developing the business in Western New York, Michigan, Ohio, West Virginia, Western Maryland and Western Pennsylvania. He was probably the best known man in that company's service.

Soon interested in other business, for he had identified himself as a new force in the business life of Buffalo, Mr. Morgan took over the Buffalo Copper and Brass Rolling Mill. The difficulties were enormous even for a man of his ability and energy. But in three years, Mr. Morgan had paid the stockholders dividends deferred for six years on the preferred stock, paid $1,000 per share dividends on the common stock, paid off the company's bonded indebtedness of $3,500,000 and spent millions for plant expansion that brought more millions back to the company and its stockholders.

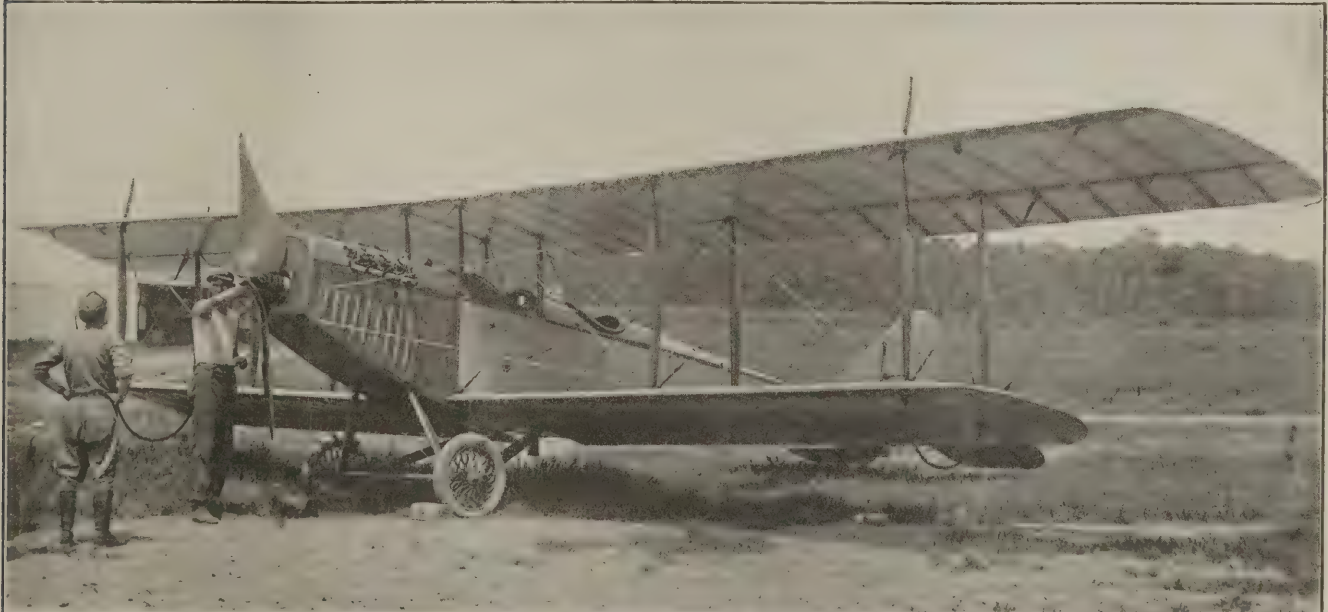
In his success, he wanted others to benefit but the wide beneficence of his charities could not long remain unnoticed by the press. Modest almost to shyness for all his activity, Mr. Morgan is essentially a home man. While in California for the Swift Company in 1895, he married Marion N. Davis of Buffalo, and they have four children. Mr. Morgan is a member of the Buffalo Club, Ellicott Club, the Automobile Club, the Park Club, Wanakah Club, the Buffalo Orpheus and of the Buffalo Chamber of Commerce as well as the Union League Club of New York City and the Toledo Club of Toledo, Ohio.

Standardizing Aero Parts

The aeronautical standards division of the Society of Automotive Engineers, which is co-operating with the aircraft production board of the Council of National Defense in standardiziation of materials to be used in the construction of the American aircraft fleet, has adopted specifications for the tension wires to be used in building and assembling the planes. It also discussed aeronautical steel specifications.

The specifications for materials determined upon by the division, acting in co-operation with the aircraft board, will be based on the best modern practice and experience, and will be used as standard for machines for both the Army and Navy. Such a policy will, according to the division, greatly simplify the requirements to which material producers will be compelled to conform and thus promote quantity production.

The engineers present at a recent meeting included Charles M. Manly, M. W. Hanks, Spencer Heath, Thomas H. Huff, G. C. Loening, H. C. Dickinson, F. W. Caldwell, F. G. Diffin, Karl Zimmerschied of the automotive committee of the council, Roger Chauveau, and Coker F. Clarkson.



Curtiss J.N.4B. tractor biplane equipped with the new type propeller invented by Dr. Olmstead, being prepared for test at an army aviation field.

Activities at Various Aviation Camps Set Forth In Recent Reports to War Department

The aviation section of the United States Army is in receipt of a number of dispatches telling of the activities in various aviation camps, and has authorized publication of the following:

Camp Kelly, San Antonio, Tex.—The total flying was 20 hours, 38 minutes, by 11 machines, making 12 flights. Cross-country flights to Waco were made, remaining overnight and returning the following day. Other flights were made to Austin and other places. Captain Thomas S. Bowen, United States Army, is in command of the aero squadron concerned.

Aero Squadron, Columbus, New Mexico—Routine work under Captain William A. Robertson, junior military aviator, commanding, including classes in electricity, radio-telegraphy, and rifle practice, continued.

Camp Kelly, San Antonio, Tex.—Routine work for this squadron. Lieutenant Buckley has been transferred to Fairfield, Ohio. Captain B. M. Atkinson is in command.

Reserve Squadron, Essington, Pa., July 7—During the week the squadron performed its usual duties. A sturtevant seaplane was received and a number of motors. The thrust bearings on two motors were changed so that they could be used in pusher machines. Seventy-nine flights were made, with a duration of 27 hours, 22 minutes, in instruction.

Washington, D. C., July 20—The aviation field at Mineola has been designated as Hazelhurst Field; that at San Diego as Rockwell Field; Belleville, Ill., Scott Field. The fields established at San Antonio will be known as Camp Kelly, and the separate fields designated by numbers.

Essington, Pa., July 21—Ninety-four instruction flights were made during the week, totaling 32 hours, 24 minutes in duration. A new Sturtevant tractor hydroplane arrived during the week. Enlistments for flying duty continue.

Col. William S. Mitchell, head of the American Aeronautic Mission to France, was officially received recently at the Aero Club of France. Speeches were made by Henry Deutsch de la Meurthe, president of the club; Daniel Vincent, Under Secretary of Aviation, and Senator Gaston Menier.

Col. Mitchell warmly thanked the speakers in the name of American aviators and spoke highly of the perfect cooperation he had found in official, military and private aviation circles.

President Deutsch de la Meurthe presented a silver plaquette to Col. Mitchell.

Stengel Gets Commission

Henry I. Stengel, late in charge of dynamometer testing of the Aeromarine Plane and Motor Co., for the past five years, has received a commission of Lieutenant (j. g.) in the Naval Reserve Flying Corps, Class 5, and has been assigned to duty with Lieut. H. W. Schofield, U. S. Navy Inspection Office, Curtiss Aeroplane Co., Buffalo, N. Y.

A group of aviation students at one of the army training fields.

New Curtiss Factory Site

Curtiss Aeroplane Co. has purchased 90 acres of land in Buffalo, and anticipates the erection of a factory which will allow for the production of 9,000 Curtiss aircraft before June, 1918.

Fisher Bodies for Aeroplanes

Detroit.—The Fisher Body Corporation is erecting in West Detroit a plant which will cover 10 acres, intended particularly for aeroplane body manufacture. The planes will be made here and the engines supplied by the Government from other plants. tI is intended to make, assemble and fly the aeroplanes in the Fisher organization, and to turn them back to the Government complete. The initial Fisher order is for 500 planes, totaling $5,000,000, which is in the nature of a trial and after this order has been completed to the satisfaction of the Government, there is no limit set as yet on what will eventually be turned out.

This 10-acre plant will be erected in sections by the Fisher Body Co., itself, and each section will be of standard size and of standard construction, so that the plant can be added to at any time while the aeroplanes are under construction in the units already set up.

The purchasing and experimental offices have been installed in the old Bour-Davis plant at Fort and Twenty-third Streets, Detroit, on the top floor. The Hinkley Motors Corp. in which the Fishers and Mendelssohns are financially interested occupy the bottom floors. The type of plane built by the Fisher Co. is the Dayton-Wright machine, and the chief engineer of the Dayton-Wright Co., is at present in Detroit, arranging the preliminary details of manufacture.

Mr. Glenn L. Martin, pioneer constructor and now vice-president of the Wright-Martin Aircraft Corporation

The staff of the Fisher Body Co., taking care of the aeroplane work, has been taken from the body plant and released from all duties in connection with it. The purchase of supplies and materials is already going on and several sections of the 10-acre plant will be in operation in 60 days.

Aeroplane Plant Plans Held Up

Toledo.—Plans for the aeroplane engine and assembly plant of the Curtiss Aeroplane Co. in Toledo have been held up for 30 days.

This announcement was made last Thursday by John N. Willys, president. The unsettled conditions at Washington are responsbile for the delay and it is possible that the larger amount of Curtiss planes will be constructed in the Buffalo plant.

At the Buffalo plant, Mr. Willys says, the Curtiss company expects to turn out approximately half of the Government's needs. Already contracts which will mean more than $200,000,000 annually have been awarded to the Curtiss company.

British Embargo On Aeroplane Drawings

London, July 21.—Exportation of designs, drawings, specifications and other descriptions of aeroplanes or other aircraft or engines or accessories is prohibited by Great Britain.

Army and Navy News

Capt. Adlai H. Gilkeson, junior military aviator, Signal Corps, now on duty at the Princeton University, Princeton, N. J., is appointed an acting quartermaster for the time he may remain on such duty.

Capt. Roy A. Wilson, Medical Reserve Corps, is relieved from duty at the medical officers training camp, Fort Benjamin Harrison, Ind., and will proceed to Mount Clemens, Mich., and report in person to the commanding officer, Training School, Aviation Section, Signal Corps, for duty as a member of the examining board.

Farewell Luncheon to Wendell and Post

A committee of the Aero Club of America, consisting of Messrs. Alan R. Hawley, Henry Woodhouse, Arthur Johns, Bernard H. Sandler, La Tourette Driggs, Felix de Thiele and R. U. Conger, bid farewell to Mr. Evert Jansen Wendell, member of the Board of Governors of the Aero Club of America, and Mr. Augustus Post, who are going to Paris to establish the "Foreign Service Committee of the Aero Club of America" to render such aid to American aviators as is possible, to look after the welfare of our flyers in Europe, and to disburse funds which will be put at their disposal by the Club.

The Committee will be formed by representative members of the Foreign Relations Committee of the Aero Club of America and the American Ambassador to France, Mr. William G. Sharp, has accepted the Honorary Chairmanship of this Committee. Mr. Wendell and Mr. Post, besides assisting in the organization of the work of this Committee, are bringing the work of the Aero Clubs of France, England and America into closer harmony. At the same time, they will take the opportunity to present the greetings from the Aero Club of America and a message from the aviators of this country to the aviators at the front, to the President of the Aero Club of France, the parent body of the aeronautic world, and to the President of the Royal Aero Club of the United Kingdom.

An instructor enlightening future navy airmen in the intricacies of naval strategy

Aviation Novices Qualify

Washington.—The War Department announced the names of additional graduates from the aviation ground schools at Cornell, the Universities of California, Texas, and Illinois, the Ohio State University, and the Massachusetts Institute of Technology.

These ground schools are being counted on to turn out more than 10,000 candidates annually. The men just graduated, whose names were made public to-day, will go to the flying schools at Mineola, Rantoul, and other points where the reward of successful work is a commission. The graduates at Cambridge and Ithaca are as follows:

F. T. Davison Is Gaining

Alarming reports as to the condition of F. Trubee Davison, younger son of Henry P. Davison, member of J. P. Morgan & Co. and Chairman of the War Council of the American Red Cross, who fell with his aeroplane into the water off Huntington, L. I., were declared to be greatly exaggerated by surgeons at St. Luke's Hospital. After a statement made by Thomas Cochran of the Morgan firm about a consultation of specialists at St. Luke's Hospital, where young Davison was taken, the report became current that injuries to his spine had paralyzed his legs and that he might never fully recover the use of them. It was said that he could not walk for a long time, possibly a year, and that he would probably never be fit for military service again.

At the hospital it was said that this version of the young aviator's injuries was much overdrawn. His legs are partly paralyzed at present, but his progress in the last few days has been very rapid and it is thought that he will be able to get about in a very much shorter time than a year. There was no indication, it was said, that he would not recover completely and be able again to enter the aviation service.

Four or five physicians and surgeons have been in constant attendance at his bedside and his parents and brother, Henry P. Davison, Jr., have been with him almost continually since he was hurt. His brother, who is also in training for the aviation service, went back to Huntington, unshaken by the accident, to resume his schooling.

The entire Davison family is engaged in some sort of war work. Mr. Davison is giving all his time to the Red Cross, his wife is engaged in relief work, and the two daughters, Alice and Frances, have learned wireless telegraphy.

Personal Pars

Benjamin Halleck, a 19-year-old Brooklyn boy of 97 Genmore place, has also enlisted in the Royal Flying Corps. He left for Toronto last Monday. He entered the British service after the United States refused his application.

Recently commissioned captain in the officers' reserve corps, Kenneth C. Grant, division engineer of the Miami conservancy district, has been assigned to duty in Washington in connection with work of the aircraft production board. He left for the capital Monday evening. tI is understood he will be employed in an advisory capacity.

Army and Navy News

Captain Shepler W. FitzGerald, S. C., to Toronto, Canada, and assume command of a detachment of the Aviation Section now undergoing instruction there. (July 25, War D.)

Captain Leslie MacDill, S.C., to Fort Sill, Okla., School for Aerial Observers, for duty. (July 26, War D.)

Captain C. W. Howard, S.C., to Fort Sill for duty. (July 26, War D.)

Captain Clarence C. Culver, now detached in the Aviation Section, S.C., is rated as junior military aviator. (July 26, War D.)

Captain Hugh J. B. McElgin, Av. Sec., S.C., to Fort Monroe, Va., for duty. (July 27, War D.)

The following provisional aero squadrons, Signal Corps, Camp Kelly, South San Antonio, will proceed, so as to arrive not later than July 10, to stations as indicated below: The 8th and 9th Provisional Aero Squadrons, S.C., to Aviation School, Mount Clemens, Mich.; 10th Provisional Aero Squadron, S.C., to Aviation School, Rantoul, Ill.; 12th and 13th Provisional Aero Squadrons, S.C., to Aviation School, Fairfield, Ohio. (July 4, S.D.)

Officers of Av. Sec., S.O.R.C., to duty as follows: Captain R. Gilder to Washington; Capt. E. Lazar to Army Balloon School, Fort Omaha; Capt. John Sloan to Hampton, Va.; as assistant superintendent of construction at Langley Field; 1st Lieutenants J. D. Este, R. Oldys, R. G. Page and C. G. Sellers to Fort Sam Houston; 1st Lieut. Leon Richardson to report in person to commanding general, S.D.; 1st Lieut. F. L. Isbell to report in person to commanding general, S.D.; 1st Lieut. L. F. Whitney to Washington. (July 25, War D.)

First lieutenants, Av. Sec., S.O.R.C., to duty as follows: H. M. Smith to Aviation School, Rantoul, Ill.; R. E. Vaughn and A. R. Stevenson, Jr., to Hampton, Va.; P. E. Baker and T. D. Dixon to San Diego, Cal.; W. F. Banks and F. Evans to Mineola, N. Y.; R. H. Carpenter, R. C. Disque and G. B. Molten to Rantoul, Ill.; M. E. Knight and H. Weinstein to Dayton, Ohio; P. Pierce and F. Robbins to Mount Clemens, Mich.; E. R. Scroggie, J. C. Tips, E. E. Weise and R. D. Wilson to Fort Sam Houston. (July 24, War D.)

Captain Courtney P. Grover, M.R.C., to Fairfield, Ohio, Flying School, Aviation Section, S.O.R.C., for duty as post surgeon. (July 26, War D.)

Active Duty for Aviators

The following-named officers of the Aviation Section, Signal Officers' Reserve Corps, are assigned to active duty and will comply with the following orders:

First Lieuts. Paul E. Baker, William F. Banks, Russell H. Carpenter, Robert C. Disque, Thomas D. Dixon, Frank Evans, Morris E. Knight, Joseph G. B. Molten, Percy Pierce, Franklin Robbins, Eugene R. Scroggie, Julius C. Tips, Jr., Henry Weinstein, Edwin E. Weise and Reynolds D. Wilson.

First Lieuts. Baker and Dixon will proceed to San Diego, Cal.

First Lieuts. Banks and Evans will proceed to Mineola, Long Island, N. Y.

First Lieuts. Carpenter, Disque and Molten will proceed to Rantoul, Ill.

First Lieuts. Knight and Weinstein will proceed to Dayton, Ohio.

First Lieuts. Pierce and Weinstein will proceed to Mount Clemens, Mich.

First Lieuts. Scroggie, Tips, Weise and Wilson will proceed to Fort Sam Houston, Texas.

Navy Aviation Station

Washington.—The Senate Naval Affairs Committee reported to-day a bill for the purchase of a site for an aviation station and grounds at Cape May, N. J.

New War Industries Board to Begin Activities At Once

Frank A. Scott, chairman of the newly created war industries board of the Council of National Defense, which is to have general supervision over the war-industrial activity of the Nation, announces that the new board will be organied at once. Two or three of the members are out of town and messages have already been sent to them urging their presence in Washington at once to assume their new duties.

"Nations, not armies, are the units of modern war," Mr. Scott said in discussing the task before the board. "Nothing less than the full power of our country must be exerted. Every resource, human and material, must be placed at the disposal of our Government. In war, time is of the essence, and this applies as well to the production of the things necessary for the soldier as to the movements of armies. This thought the American people must take home.

"If it can be said that there has been a preliminary stage of our share in the war, it is over now. Our troops are already in France and we have begun the actual raising of a huge army here at home to be sent abroad when the time is ripe. It was hard at first to realize that the country had actually entered the struggle. That time has passed and we are facing the actual fact of participation. It is for us

The latest type of Sturtevant motored Sturtevant seaplane undergoing trials at a naval station.

here at home in civil life, for American industry, to make it plain that we see clearly what we are facing and that we give our fighting men the support due them. We have passed the period of expectation—we are waging war.

"Only a part of modern war is fought on the battlefield. An important part is fought in the mines and workshops, in the harvest fields and shipyards. Efficiency and economy in producing and distributing the Government's requirements are as necessary to success as courage and intelligence in battle. The slacker at home is as contemptible a figure as the coward in the presence of the enemy. The luxuries of peace must give way to the necessities of war.

"We must standardize, economize, and then produce, produce, produce. This country has the three great necessities for making modern war—men, metal and machinery. We must make them all available now. Until we can claim the victory 'SPEED' must be our watchword.

"Artillery, ammunition, aircraft manufactured to-day may save the lives of countless American soldiers. If we love our country, if we love our sons, now is our chance to express it in action. Days saved now in the production of war needs will mean lives saved hereafter when our troops take the field."

Jennett Joins Aerial Age Staff.

Aerial Age takes pleasure in announcing that Norman E. Jennett, who for the past sixteen years has been on the New York Herald art staff, has been appointed Art Editor. Mr. Jennett has had a very wide and varied experience in art work, and in the columns of Aerial Age we hope to present startling cartoons, serious and humorous, from his pen. With the rapidly expanding aeronautic industry it will be necessary to keep the artistic side of aeronautic journalism abreast of the technical, and we are confident Mr. Jennett will keep Aerial Age abreast of the best in the field.

Mr. Jennett will also contribute regularly to Flying, his newest creation, a humorous series entitled "Our Sammies in the Air," which is very unique and we are sure will prove abundantly entertaining to that magazine's readers.

Advance Payments for Aeroplanes

(Editorial in New York *World*)

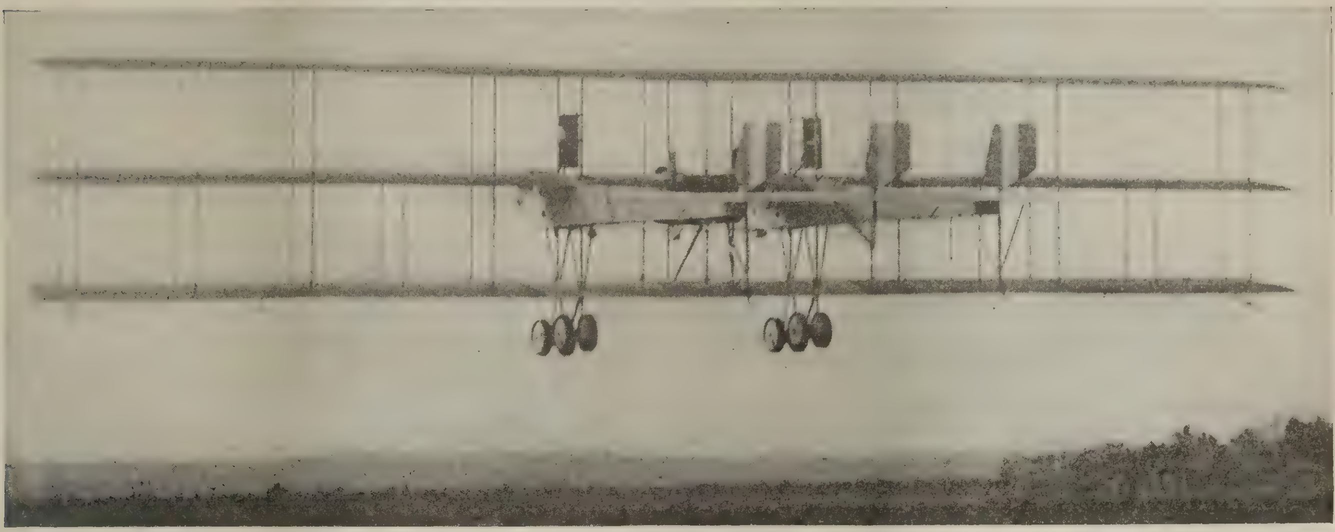
In spite of the commendable promptness with which Congress passed the Aviation Bill, there is one serious omission which can be remedied only by separate enactment. The Government should be empowered to make advance payments to makers of aeroplanes when necessary.

This provision will prove desirable in most cases; it is indispensable in many, where rapidity is the prime consideration. Where a manufacturer has to alter his factory and set up new equipment for the work, he should not be delayed for a single hour looking for money with which to finance the operation. Time is the important thing. The Government should sweep away all possible obstacles to swift production.

Almost from the beginning of the war the British and French Governments adopted a liberal policy in advance payments not only to munition manufacturers at home but to those in the United States. It paid well in quick results, then as now the prime necessity. The United States cannot afford to be less distinguished in foresight.

Not one needless hour should pass before our aeroplanes are flying above the battle-line. Where ready money will help, set it to work.

Views of maneuvres at the Curtiss training ground at Buffalo in honor of the visiting Russian Commission. (1) Glenn H. Curtiss welcoming the Commission. (2) Left to right (central figures) General Koop, Lieut. Piotrowsky and Mayor Fulerman. (3) Aviation students and their equipment lined up for review. (4) Another view of the review.



The huge three motored Caproni Triplane, which it is expected will arrive in America in the very near future.

AMERICA MUST PUT 22,000 AEROPLANES IN FRANCE BY DECEMBER, 1918, IF SKIES ARE TO BE CLEARED OF GERMAN AIRMEN

THIS is the third of three interviews on aviation and its achievements on the European battle fronts by Captain de la Grange, of the French Aviation Corps, issued by the committee on public information. Captain de la Grange has fought in the air extensively almost from the beginning of the war and is reputed by authorities to have rare knowledge of the actual capabilities of aeroplanes in actual warfare and of the technical difficulties arising in their manufacture.]

"I have spoken already," said Captain de la Grange, "of the great help America can bring to the allies in 1918 by establishing allied superiority in the air. We know that this superiority would secure a speedier and more decisive victory."

The captain said he is sure that the most effective and quickest way in which the United States can help the allies is in aviation. "The formation of a large aviation section by the United States," he said, "is only a question of money. It takes three to four months to train a pilot. We have already seen how quickly sturdy young men can be turned into excellent aviators. In less than a year it would be possible to have more than 5,000 pilots. These pilots would be trained for the first few months in the United States and for the last months in the American school that is now being created in France, at Issoudun.

"The important question is that of material. The experience of the last three years has permitted the allies to create models of military aeroplanes which fulfill all that is demanded of them—great climbing ability, great horizontal speed, ease of handling at high altitude, and power to carry arms. The American Government has the possibility of building these motors and these planes and of giving them to their pilots.

Requires Great Effort

"If the Government wishes to, before the 1st of April, 1918, it can have a tremendous aero fleet. Suppose it decided to have only 5,000 planes and 10,000 motors. In order to keep that number of aeroplanes always at the front it will be necessary to build 2,000 planes and 4,000 motors per month, viz., 18,000 planes and 36,000 motors during the next nine months. Therefore, between January 1, 1918, and December 31, 1918, the United States must build 22,000 planes and 46,000 motors. This means a great effort on the part of the American factories. They can make this effort, as they have already the buildings, the workmen, and part of the machinery needed. They have also a large number of the best scientists and technicians. The size of the orders given them will insure obtaining the money necessary to organize the plants for their construction.

"Two difficulties will be met at once, the first, that of skilled labor. The American industry has, as far as possible, replaced manual labor by machines. The following motto is written in one of the American factories: 'Manual labor must be abolished whenever a machine can take its place.' In constructing aeroplanes, machines are not sufficient; very good fitters are needed, and a great number of them also; they must be taught the methods used in French and English factories.

"The necessary steps should be taken to recruit these men as soon as possible, and in view of this the board of production is sending a commission, composed of skilled workmen, to France, so that they should study the methods used in the factories there. When finished, they will return to the United States, they will apply all they have learned, and will be able to train the workmen as well.

"The second difficulty is that of manufacturing quickly enough machines and tools necessary for building such a large supply of planes and motors. Although the best American engineers are giving all their attention to this, it will be impossible, I am afraid, to build these machines fast enough so that at the 1st of January, 1918, each factory will be able to produce not 10 motors per month, but 20 and 30.

Day and Night Shifts

"In my opinion, there is only one way in which this difficulty can be surmounted. It is to realize that the work must go on night and day, and, in consequence, to organize night shifts so that the machines will never be idle. The French workmen, when they understood how important it was to turn out for the front planes and motors in great numbers and as rapidly as possible, did not hesitate to adopt night work, because they knew that their work at the factories would save the lives of their comrades who during this time were fighting in the trenches.

"In order to examine every phase of this problem of intensive American production, we must take up the question of transportation from America to France.

"From now until January, 1918, the proposed construction of boats will augment the tonnage available, and this will permit the transportation of the 2,000 tons monthly. This represents the 4,000 motors which are to be sent every month. But I do not think it will be possible to transport the fuselages or bodies, which, though light in weight, take up a great deal of room; therefore, it is important to consider the possibility of creating aviation factories in France. There must be two kinds of factories, the first to build the fuselages and to do all the wood construction, the second to repair the motors sent back from the front.

Quickest Way to Help

"I am convinced that the quickest way in which the United States can help the allies is by aviation. In nine months from now, on the 1st of April, 1918, I am sure it will be possible to have a corps of 5,000 aviators trained, equipped, and armed. These men will fight splendidly, because they are full of the sporting spirit, in good physical condition, and very courageous. As soon as they arrive on the front, the balance of the aerial supremacy will weigh heavily in the favor of the allies.

"In contrast to this, it is difficult to organize in nine months an army which will be as well trained as that of the allies, whose armies have been fighting for three years.

"To résumé all that has been said, the primordial importance of the aviation in modern battles is no longer questioned by anyone. The allies acquired and have kept the supremacy of the air, but they cannot develop their aviation to any further point. The arrival next spring of a corps composed of 5,000 American aviators would assure the absolute supremacy of the allied aviation; it would greatly hasten the final victory, and it would save millions of dollars and thousands of lives.

United States Equal to Task

"The United States can make this great industrial effort and can equip this corps of aviators. In order to do this 5,000 planes and 10,000 motors must be built before April 1, 1918, and 22,000 planes and 46,000 motors before December 31, 1918."

Captain De la Grange was asked how, in his judgment, this result should be brought about.

"First," he said, "a large industrial commission should be sent to France.

"Second, a large number of skilled workmen should be recruited.

"Third, the factories must work during the night as well as the day.

"Fourth, the manufacturers must increase the number of their machines.

"Fifth, American factories must be created in France."

He said that the effort to accomplish all these things is possible and that "if the Americans set out to do it, they *will* do it."

Must Allow No Delay

He added: "You will understand the necessity of my suggestion when you examine the whole situation thoroughly. The whole country must line up to make the American eagle supreme. The whole country is interested in the success of the program. The Army is interested, too, especially in training pilots. The manufacturers are interested in producing aeroplanes. Public opinion must help carry through these measures. It must allow no delay and be impatient to see the results obtained. Every man realizes, almost, that the easiest way and the cheapest way, both in lives and money, to win this war is to build an overwhelming number of aeroplanes. And France and the other allies know that, and they are waiting for the leadership of America in this its own special field."

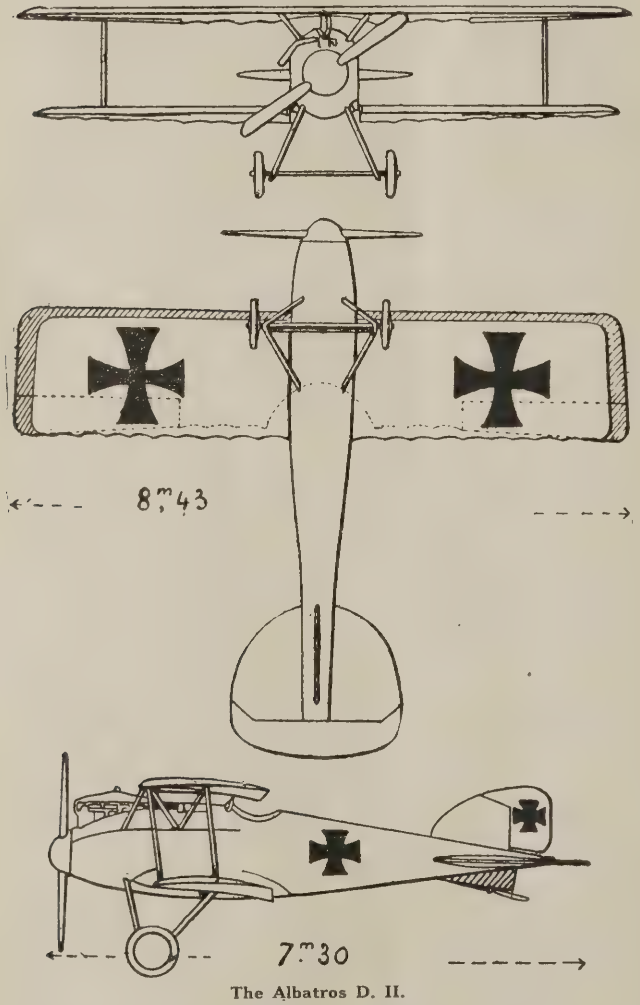
GERMANY'S LATEST AEROPLANES

SOME very interesting particulars of several of the latest German aeroplanes, which we publish below, are compiled by Mons. Jean Lagorgette. The drawings accompanying the article are in the majority of cases approximately correct as regards scale, and a brief description of each will, therefore, suffice to give an idea of the general characteristics, for the basis of which we are indebted to our contemporary, *L'Aerophile,* and for the translation which appeared in *Flight.* On page 777, are scale drawings of the Gotha twin-engined biplane which took such a prominent part in the raid on London recently. The scale drawings are the first to be published in this country.

SINGLE SEATER CHASERS

The Albatros D. I. and D. II.

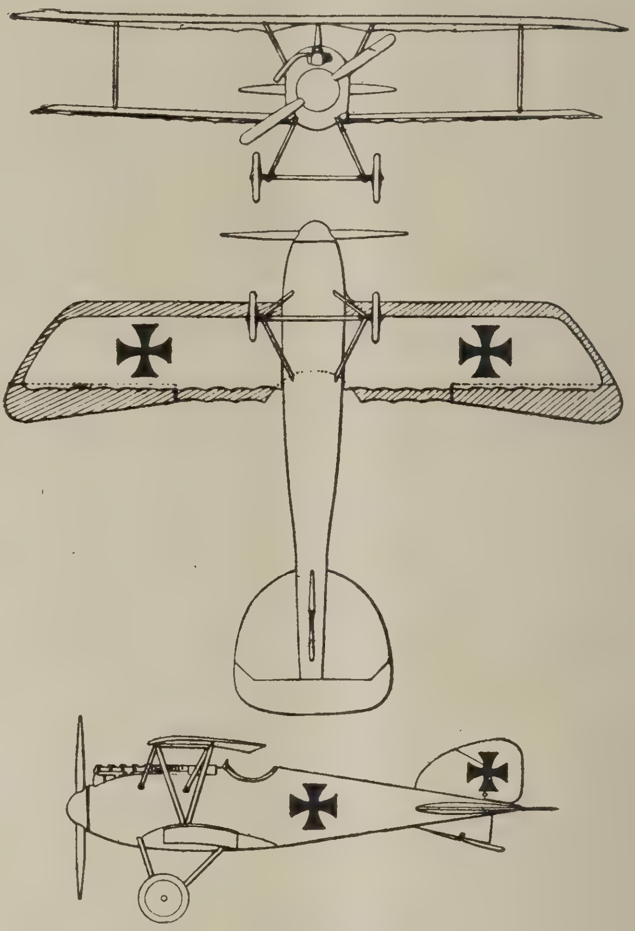
These machines are built by the Albatros works at Johannisthal, Berlin, and its various branches, and under license by the Bavarian Aircraft Works at Munich. As a detailed description of the D. I type was given in the April 30th issue of Aerial Age, there is no need to deal with it here. The D. II resembles it very closely, except for minor alterations. For instance, the gap between the planes has been decreased, bringing the top plane much closer to the body, to which it is attached by two sets of struts in "N" formation, sloping outward slightly after the fashion of the Sopwith one and a half strutter. In this type no provision is made for varying the stagger. In all other respects the D. II resembles closely the D. I, small alterations in dimensions being scarcely noticeable, except under the tape measure.



The Albatros D. II.

The Albatros D. III.

This machine shows more noticeable alterations from the original design. The body, tail planes and chassis remain practically as before, but considerable changes have been made in the wings. Thus it will be noticed that the upper plane has its tips raked to a much greater extent than was the case with the older models. The bottom plane has been reduced in area, mainly by decreasing the chord. While the upper plane is still without dihedral angle, this feaure has been employed for the lower plane, and the inter-plane struts are of the Vee formation familiar from the French Nieuport chasers. The attachment to the body of the top plane is by means of two struts on each side, sloping backwards and outwards. Instead of the small radiators mounted on the sides of the body, the radiator is mounted in the centre section of the top plane, and the small water tank formerly mounted above the engine has therefore disappeared. In other respects the D. III does not differ greatly from previous models.



The Albatros D. III.

Torpedo, D. (L. T. G.).

The Luft-Torpedo-Gesellschaft, of Johannisthal, built a chaser which they call the "Aerial Torpedo." This machine is very similar to the Albatros chasers, but has its top plane resting on the top of the body, and its rudder projecting below the tail plane as well as above it.

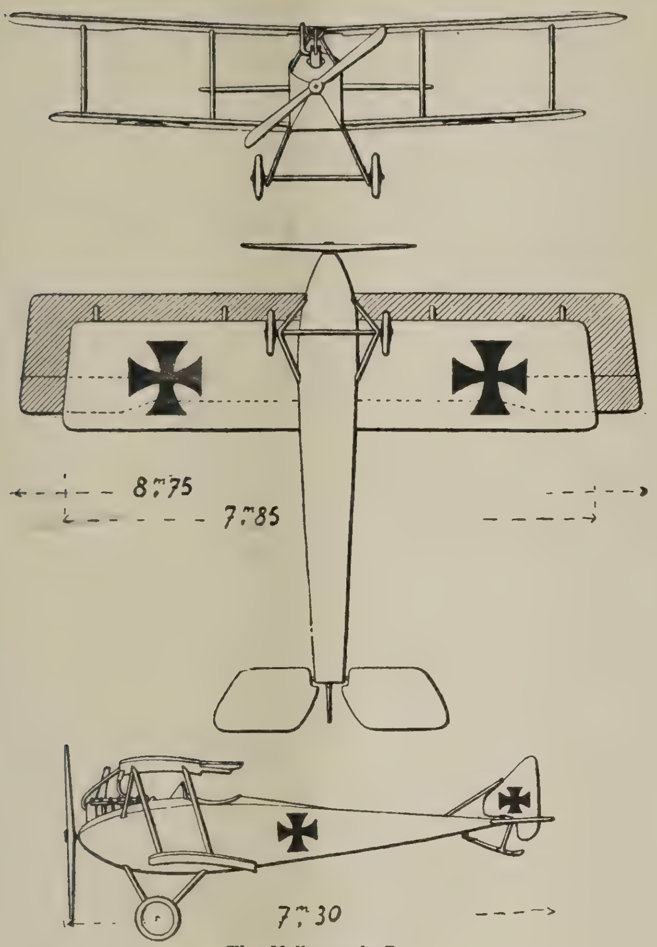
The Roland Chaser, D. II.

Differs somewhat from the Roland two-seaters in several respects. It is chiefly characteristic on account of the peculiar arrangement of the top plane attachment, which secures the upper wing spars to an enclosed upward projection of the body. Constructionally the body is of the true monocoque type, without internal bracing. It is of rounded section, and throughout the whole machine great care has been taken to do away with sharp corners and angles, to reduce head resistance to a minimum. The main planes, of which the upper measures 29 ft. 6 in. and the lower 28 ft. span, have no dihedral, but are swept back as was once the custom in a large number of German aeroplanes. Ailerons are fitted to the top plane only, and are operated Nieuport fashion by cranks on tubes running along the rear spar. The chord of both planes is the same, 4 ft. 9 in. The stabilizing plane and the vertical fin are covered with three-ply wood, and both rudder and elevator are partly balanced by triangular projections, as appears now to be the mode in Germany. The engine fitted is a 175 h.p. Mercedes, with the exhaust pipes bent outward and backward as on the Albatros. The radiator is incorporated in the centre of the top plane. Two machine guns are fitted, one on each side of the engine, and, of course, with the usual interrupting gear. The weight of the machine empty is 1,450 lbs.

The Halberstadt Chaser.

Details of this machine are already familiar to our readers through an illustrated description which appeared in the issue of June 4th, 1917. We are now able to supplement the information then given by approximate scale drawings and other data from *L'Aerophile.* The Halberstadt chaser is a single-seater of short span—28 ft. 6 in. and 25 ft. 9 in.—and has, as distinct from the majority of other biplanes of the chaser type, two pairs of inter plane struts on each side. The wings are staggered, and have a dihedral angle, but are not swept back. Ailerons are fitted to the top plane only, and are warped, their angle of incidence decreasing progressively toward the tips. They are hinged, as in nearly all German machines, not to the rear main spar, but to a false spar placed between the rear spar and the trailing edge. The chord of the wings is just under 5 ft. and the gap 4 ft. 3 in. The result of this small gap is that the top plane is very low over the body, a tendency in German design that is very noticeable of late.

The engine usually fitted in the Halberstadt chasers is a 120 h.p. Argus 6-cylinder water cooled. It has overhead valves, which are not,

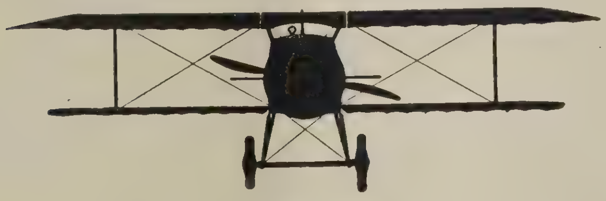


The Halberstadt D.

however, operated by an overhead camshaft as in the Mercedes, but by tappet rods and rockers, as in the Benz. The petrol tank, which also serves as a seat, has a capacity of 76 litres (about 17 gallons). The pressure in the tank is maintained by a pressure pump driven off the engine, a hand-operated pump being provided for cases of emergency. The petrol service tank, which has a capacity of 18 litres (about 4 gallons), is built into the centre setion of the top plane, where are also mounted the radiator and small water tank.

The "Rex" Chaser.

A small, single-seater biplane, built by the Rex Company, of Cologne, has been observed at the front, but little is known regarding it except that it is apparently somewhat similar to the Nieuport, in that the lower wing is of smaller span and chord than the upper. Also, the interplane struts—of which there is only one pair on each side—are placed in the shape of a V. It differs from the Nieuport, in that the upper plane has no sweepback, and the lower neither sweepback nor dihedral. The centre section of the top plane is attached to sruts sloping outwards, as in the Sopwiths. The body is of the monocoque type, built of three-ply wood, with projections for the attachment of the lower planes. In front view this machine appears approximately as shown in the accompanying silhouette.

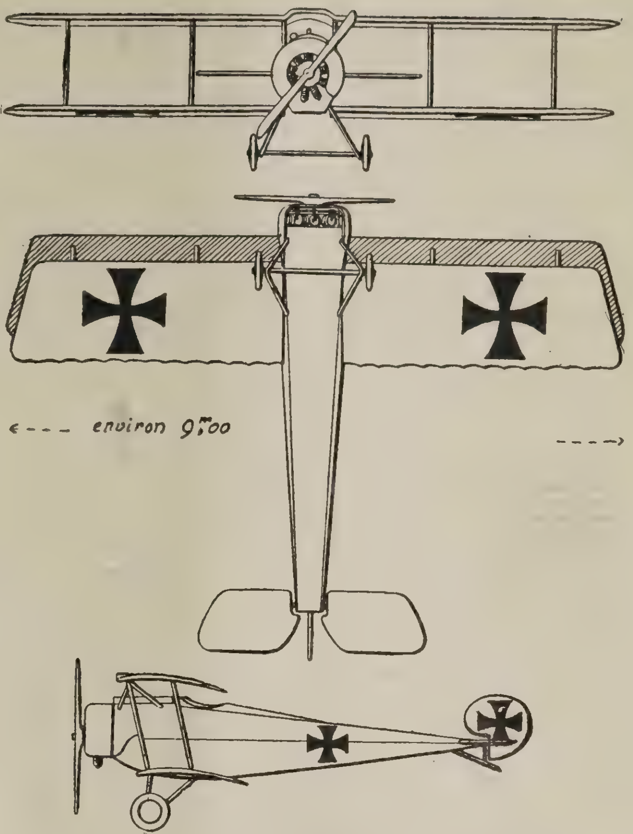


The Rex Chaser.

The Fokker Chaser Biplane.

Two types of this machine have been turned out by the Fokker firm, one with a 100 h.p. rotary engine (Oberursel) and the other with a 175 h.p. Mercedes. No specimens of these machines have been captured—at least, not in a condition to provide much information—but photographs of one which landed in Switzerland give a good idea of the general arrangement. Both wings, upper and lower, are of equal dimensions as regards span and chord (29 ft. 6 in. and 4 ft. 10 in. respectively). There is neither dihedral angle nor sweepback, but a fairly large stagger. The gap is small, bringing the top plane down almost to the upper longerons of the body. A low cabane of the Nieuport type connects the upper plane and the body. The centre section of the upper wing is raised above the rest of the plane so as to give the pilot a better view and facilitate getting ino or out of the cockpit.

As in the Halberstadt, there are two pairs of interplane struts on each side, these consisting of circular section steel tubes streamlined with wood fairings. Lateral balance is maintained, not by means of ailerons, as in practically all modern biplanes, but by the now obsolete method of warping the wings, the bracing being arranged accordingly.

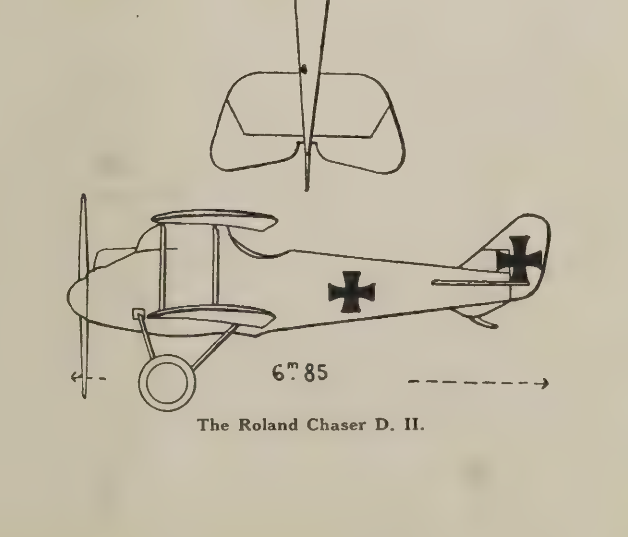


The Fokker D.

The body is of the Morane type, of hexagonal section, with a slight turtle back flattening out toward the rear. The rotary engine is overhung and partly covered in by an aluminum cowl. Above this and slightly to the right is mounted the synchronized machine gun. Occasionally two machine guns are carried, each slightly outward from the centre of the body.

175 H.P. Two-Seaters.

Of these, a considerable number have already been described from time to time, and there is, therefore, no necessity to again deal with them here. Suffice it to mention that they are, for the greater part, of very similar design whatever the make, and are used for all sorts of purposes, ranging from reconnaissance to "spotting" and bomb dropping. Generally speaking the pilot occupies the front seat, having in front of him a synchronized machine gun; while the gunner, who is installed in the rear cockpit, is provided with a gun mounted on a

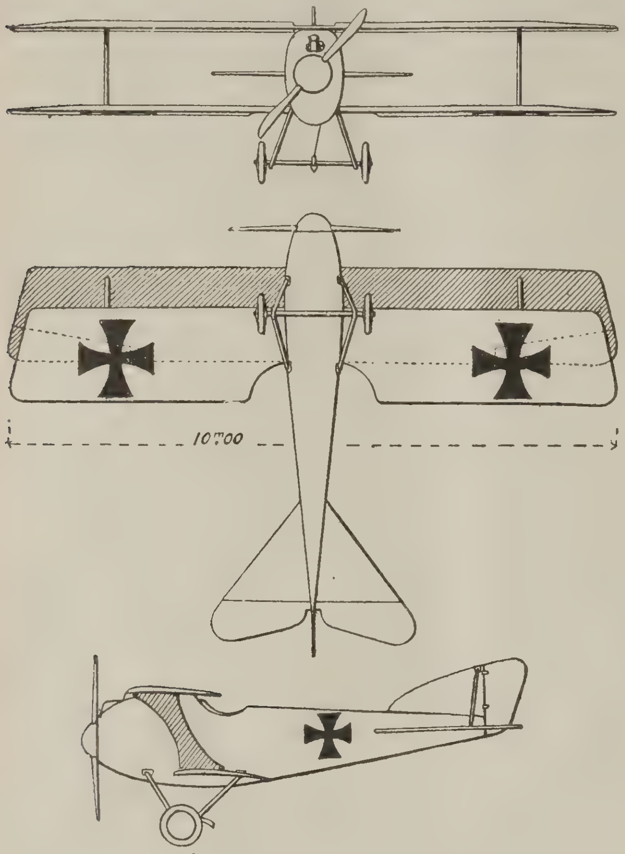


The Roland Chaser D. II.

turntable for firing in various directions. To this class belong the Albatros C. III, the L. V. G., the Rumpler and the Aviatik.

The Roland Two-Seater

Since the early days of German aviation the L. F. G. (Luft-Fahrzeug-Gesellschaft) firm have named their machines "Roland," this being the name of their chief designer. The modern Roland two-seater biplane is similar to the single-seater already described. It is considerably smaller than the other German two-seaters, the span being only 30 ft. Both wings are perfecly straight, the top one resting on the roof of the body. On each side is a single interplane strut made of ply wood and of streamline section. This member serves the dual function of the usual pair of struts and of incidence wires. The planes are heavily staggered, so much so that the rear spar of the top plane is vertically above the front spar of the bottom plane. Ailerons are fitted to the upper wing only, and are peculiar in that they are hinged along a false spar, forming an angle with the two main spars.



The Roland C., a two-seater.

The body is of three-ply wood, rounded section, and is so deep in front that windows have been provided for the pilot and gunner (who occupies the rear cockpit). The engine is a 175 h.p. Mercedes, and the armament consists of two machine guns and under the body four bombs placed longitudinally.

The A. E. G. (Type C. IV).

The Allgemeine Elektrizitäts Gesellschaft build two types of machines—one a twin-engined biplane and the other an ordinary two-seater biplane with single engine. The wings of the single-engined machine, which, like all the A. E. G. machines, is built entirely of steel tube, are of 42 ft. 6 in. span, so that the machine is a fairly large one. The wings are set at a small dihedral angle and also slope back slightly. There are two pairs of struts on each side, and the machine is remarkable for its exceptionally large gap between the planes.

The wings are built entirely of steel tube, with the exception of the leading edge and intermediate ribs. The ailerons, it will be seen from the sketch, are of rather peculiar shape, and form on that account a good guide for purposes of identification.

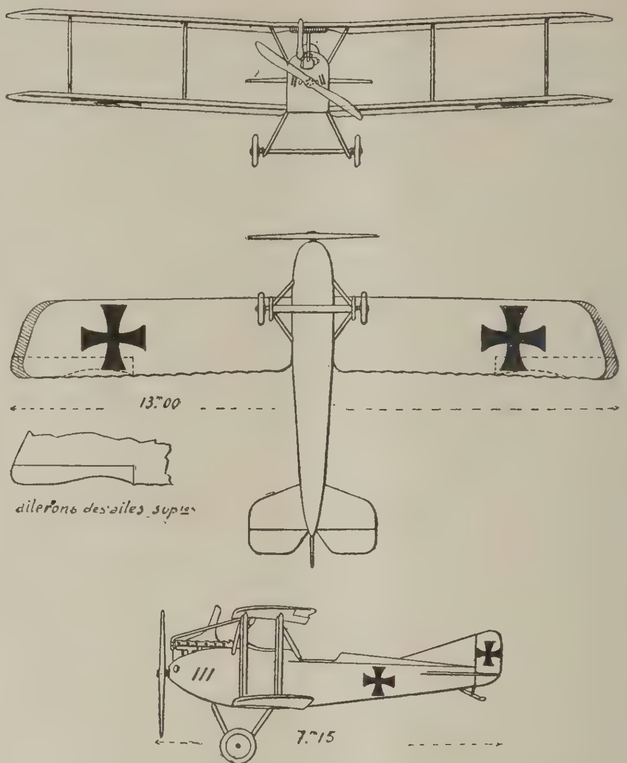
Like the rest of the machine, the body is built of steel tube, and is flat-sided except in front, where it is covered with three-ply and slightly rounded. The engine, a 175 h.p. Mercedes, is mounted on two longitudinal bearers of square section steel tube. The petrol service tank and radiators are incorporated wih the centre section of the top plane, which is straight. The armament consists of two machine guns, the front one fixed and synchronized, the rear one on a gun ring, and of four bombs placed on top of one another inside the body, to the right of the passenger.

TWO-SEATERS (225-240 H.P.).
The L. V. G. (Type C. IV).

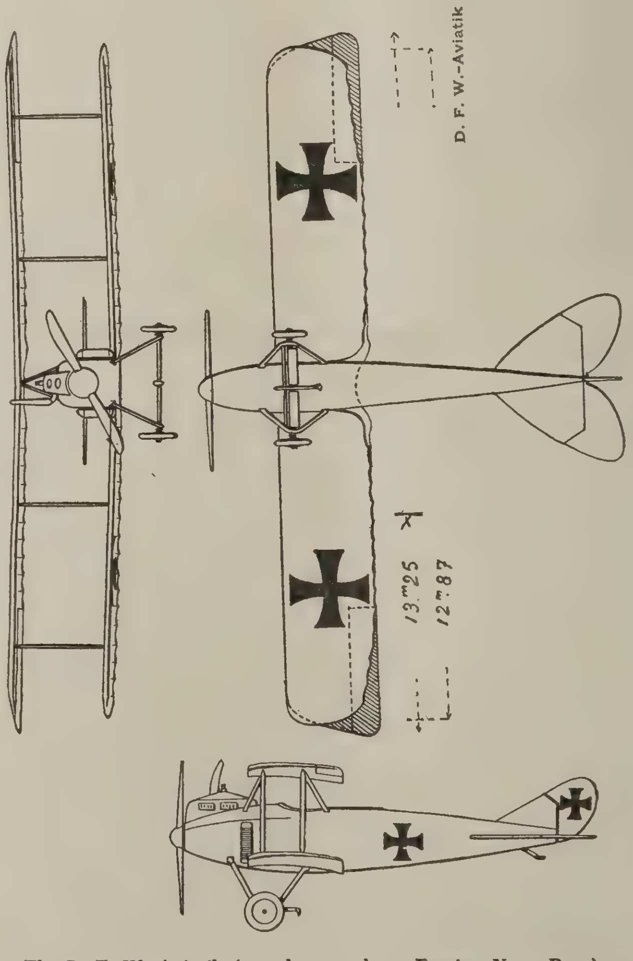
Differs very little from the L. V. G.'s already dealt with in our columns. It is of slightly larger overall dimensons, and has an 8-cylinder vertical Mercedes engine. The armament consists of two machine guns mounted as usual and of four bombs.

The D. F. W.-Aviatik.

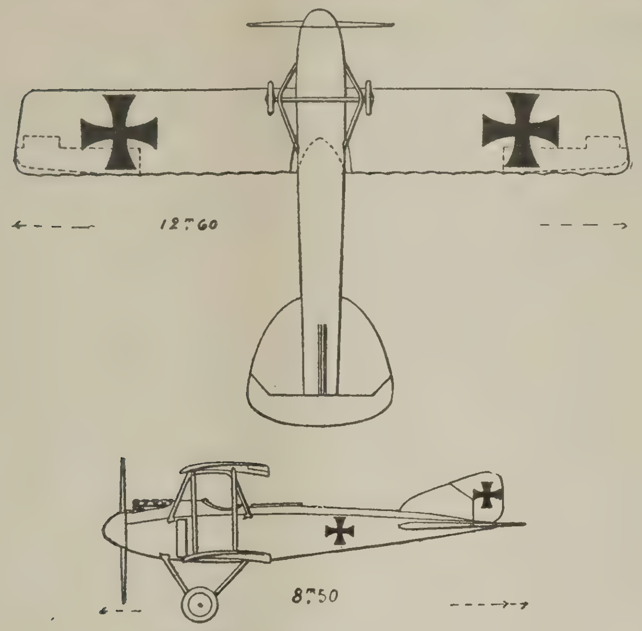
Before the war the Deutsche Flugzeug Werke, of Lindenthal, Leipzig, produced exclusively machines of the Arrow type. Since the war this type has never been in great favor, and when the firm are now producing a slightly modified machine it appears probable that this was done to meet the requirements of the military authorities. This machine is not only built by the D. F. W. firm, but also, presumably



The A. E. G. Type C. IV.



The D. F. W. Aviatik (see photograph on Foreign News Page).



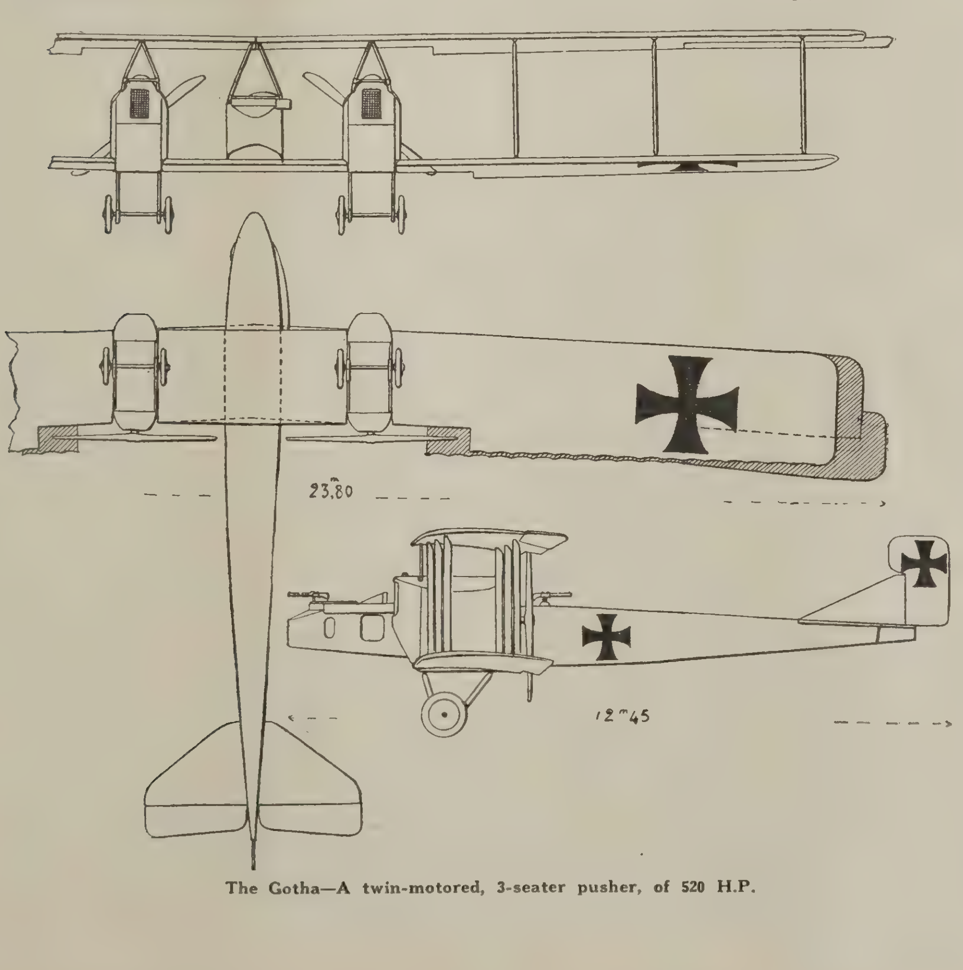
The Albatros B. F. W., Type C. V.

under license, by the Aviatik Company, another firm whose machines have not been over-popular of late.

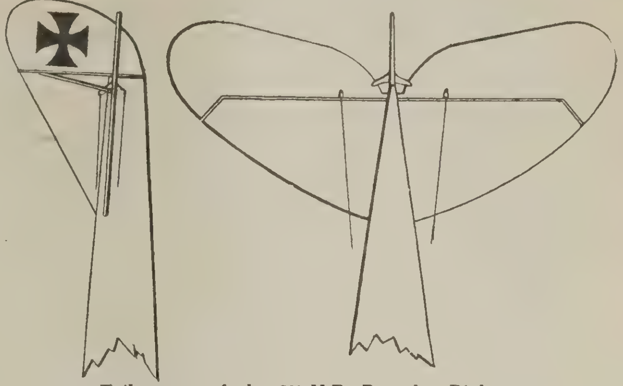
One of the chief modifications in the modern type is that the backward slope of the wings has disappeared. The dihedral angle has been retained. The body, which is of rectangular section, is covered with three-ply wood, and is very pointed toward the nose, where it terminates in a "spinner," covering the propeller boss. The engine is a 6-cylinder Benz, developing 228 h.p. at 1,410 r.p.m. The standard complement of two machine guns is carried, and the bomb chamber will hold six bombs. The weight of the machine empty is 2,100 lbs.

Albatros B. F. W. 225 H.P. (Type C. V.)

One of these machines, which was captured, had been built at the Bavarian Aircraft Works, Munich, and is almost identical with the Albatros C. III, which has been illustrated before. Only minor alterations are to be found, as, for instance, in the rudder and tail, which are similar in shape to those of the D. I. The ailerons, it will be seen from the sketch, are balanced by a portion projecting forward in an opening in the wing. The engine is a 6-cylinder vertical Benz developing 225 h.p. (1,415 r.p.m.). There are two machine guns and two bomb chambers.



The Gotha—A twin-motored, 3-seater pusher, of 520 H.P.



Tail group of the 260-H.P. Rumpler Biplane.

TWO-SEATERS (260 H.P.).

260 h.p. Rumpler.

In the main the new 260 h.p. Rumpler two-seater follows along the lines of the older model. It has, however, a 260 h.p. Mercedes engine, and the shape of the tail planes has been altered somewhat, as shown in the sketches.

TWIN-ENGINE MACHINES, TYPE G. I AND G. II.

The Twin-Engine Gotha Three-Seater, 520 h.p.

This machine will probably be found the most interesting of those included in this series, as it played such a prominent part in last month's raid on London.

Although by far the largest of the German biplanes, the Gotha is not quite so large as the British Handley-Page biplanes, the sample of which, duly delivered to them at Lille, has undoubtedly provided the Germans with valuable data for their Gotha three-seater. As distinct from the Handley-Page, however, the Gotha has its propellers at the rear of the wings, and a considerable backward slope to the main planes. Also, the tail is of the monoplane type. The top plane is built up in two halves, attached to a central cabane, while the bottom plane is in three sections, one of which runs from the inner side of one engine housing under the fuselage to the inner side of the other engine housing. The main spars are of I section with three-ply flanges. Structurally the ribs are of little interest, but as they are at righ angles to the spars they form an angle with the line of flight. This disposition also has the effect of offsetting the interplane struts, the front and rear ones of which are not in line. This, however, is not shown in the sketch.

The shape of the tail surfaces are chiefly remarkable from the fact that they are, as already pointed out, of the monoplane type. Their area is, therefore, very small as compared with that of the tail surfaces of the Handley-Page.

The long enclosed body is of rectangular section, and is covered with three-ply in front and with fabric at the rear. It is built up of four ash longerons and ash struts. The placing of the three occupants is rather peculiar, being unsymmetrical. If the gunner in the front cockpit is seated centrally in the body, the pilot is placed on the left-hand side with his controls, leaving an open space between him and the starboard wall of the fuselage. This space is, as a matter of fact, provided to form a passage from the front to the rear gunner. Behind the pilot are two bomb racks, while further back still is the cockpit for the second gunner. Two guns are within reach from this seat, one is placed above the body, while the other fires down through a tunnel sloping backward and downward from the cockpit, permitting of firing in that direction.

The undercarriage consists of two separate Vee chassis, one under each engine, and is, needless to say, built of streamline steel tubes. The engines themselves are housed in roomy nacelles resting on the bottom planes. They are 6-cylinder vertical Mercedes motors, each developing 260 h.p. at 1,400 r.p.m. The cylinders, which are 160-bore by 180-stroke, are in two groups of three each. There are four overhead valves and two spark plugs to each cylinder, and the usual overhead camshaft is employed. The radiators are mounted in the nose of the engine housing, and under them are placed the oil tanks. The main gasoline tanks are situated below the engines.

The armament consists of three machine guns, one in front, capable of being fired in any direction within the hemisphere limited to the rear by the wings. A second is mounted on a transverse rail almost touching the top of the fuselage, while a third can be fired downward and backward through a tunnel in the body. In addition, there are several bomb racks carrying a total of 14 bombs.

Twin-Engine A. E. G., 450 h.p.

It has already been mentioned that the Allgemeine Elektrizitats Gesellschaft make a twin-engine biplane. This machine, which is built entirely of steel, is fitted with two Benz or Mercedes engines of 225 h.p. each, placed in

(*Continued on page* 780)

THE TRAINING OF AERONAUTICAL ENGINEERS

By R. MULLINEUX WALMSLEY *

D.Sc., F.R.S.E., and C. E. Larard, M.I.C.E., M.I.M.E.

IN many quarters it is invariably the custom to overlook the fact that education is the most technical of all subjects, and requires as careful and laborious a study as any of those subjects which have preceded it in this course. That this is not generally recognized would be borne in upon anyone who would have the patience to read the proceedings and discussions of the numerous educational conferences which have been such a marked feature of the past winter. Education is "in the air," and has given rise to an almost endless succession of papers and speeches with little variation in the subject matter; the same things have been repeated *ad nauseam*, sometimes with very little difference in phraseology, while the number of really new ideas produced has been remarkably few. It is hoped, however, that as the authors are dealing with education for a new profession which itself is in a state of flux, they may, in what follows, contribute something of value to the general discussion. The following is, at any rate, a genuine attempt to place aeronautics on its educational side on a sound basis, so that, on this side, it may rank with the older well-established branches of engineering.

It is assumed that it is unnecessary to discuss the question as to the necessity for well-thought-out and co-ordinated schemes for the technical education of those who are to take charge in the near future of this important and scientific industry, that is, if this country is "to take the air and keep it," as has been recently well said by a well-known authority. If anything could have emphasized the point it would have been the far-reaching plans unfolded in the interesting paper of Mr. Holt Thomas and the discussion thereon barely a month ago in this series of lectures. Those plans take it for granted that a highly-trained staff of constructors and workmen will be available possessing a flexibility of mind based upon sound and varied knowledge which can only be acquired by such training as that which is dealt with in the present paper. The backbone of such a staff is an ample supply of aeronautical engineers who usually commence their professional work as technical assistants and who by habit and training are acquainted with the latest developments of the practical, scientific and industrial problems which they are called upon to face. The greater part of the paper is therefore devoted to a discussion of the methods, as they appear to the authors, of training those who are in a position to devote not less than four years to a training designed to fit them at the end of the training to commence practice as junior or senior technical assistants with every prospect of rising rapidly to higher, responsible positions. The needs of other classes less favorably placed and of those who are to fill lower positions are not lost sight of, and especially of that class of men already in the industry who must be given opportunities for keeping abreast of aeronautical developments as they proceed and of making up from time to time the ground which the strenuous nature and pre-occupation of their daily work must cause them to lose.

The main object of the paper is the professional training of aeronautical engineers, but before this can be adequately dealt with it is necessary to consider the educational foundation upon which, in the opinion of the authors, this training should be based, for one outcome of the past winter's discussions has been to bring into prominence the chaotic nature of much of the general education of the youth of this country.

Preliminary Education

The preliminary education of students who desire to be trained as aeronautical engineers should, in the opinion of the authors, be a good secondary school education, in which the student has been taught, through the medium of the proper subjects of such an education, to think and weigh evidence. If this end be attained, it is far more important than any workshop or other quasi-technical training that can be obtained in a secondary school, especially if, as is often the case, such training is given at the cost of the more essential subjects of a secondary school education. The claims of science and scientific method to be included in such a curriculum have now been practically conceded, even by many who have been for long years staunch upholders of the claims of the "humanities," to dominate the time-table to the exclusion of nearly everything else but mathematics. A good grounding in mathematics is, of course, of prime importance to the future engineer, and his curriculum must also include a good working knowledge of not less than one modern language, in view of the large amount of scientific and technical literature published in foreign journals and by foreign societies, as well as of the fact that during the next fifty years an enormous amount of engineering work will be required in countries in which English is not the varnacular and that engineering industrial developments will be the common heritage for all time of all the civilized countries of the world.

For many years science was practically tabooed in the secondary schools on the plea that there was no room for it in a time-table in which even modern languages had not a very conspicuous share. What was still worse was that the best and brightest boys, or at any rate those developing the greatest promise, were never given a chance of showing their attitude for a scientific training, but at an early period of their school career were set to specialized studies in the humanities, including an excessive amount of time devoted to Latin and Greek, so that in due course a small minority of them might bring renown and distinction to the school by winning university scholarships. Meanwhile, as a sop to public opinion, a "modern" side was formed, to which only the conspicuous failures were drafted.

These evil methods still persist in certain schools, but other dangers have more recently begun to show themselves in quite another direction. There is now a danger that science may not be adequately dealt with because of the desire to include "engineering" subjects in the time-table. The prospective engineer should first be well educated, in the proper sense of the word, in mathematics, in the humanities (but including English and modern languages), and in science, his education in science being with a view to training in scientific method rather than to the handling of a large number of subjects. An education which adequately covers this range will certainly fill the limited time of the average boy and will satisfy the ambition of the most voracious schoolboy. The intensive study of the sciences on which all engineering is based as well as the special "engineering" subjects which, of late years, are becoming fashionable in certain schools, will be far more advantageously and economically postponed until the time when real professional training is undertaken.

If the student has received a good education, in the sense set forth, he should be ready to start his engineering training by the time he reaches the age of 17 in the case of the best students, and at 18 in the case of students whose development is not so well forward. From the engineering point of view, the retention of a youth at a secondary school beyond these ages for the purpose of taking so-called "engineering subjects" constitutes a very serious loss of time, in view of the fact that such subjects cannot be properly and economically taught, except in correlation with a systematic and well-organized complete engineering course, and further, such work cannot in general be effective when undertaken by any but a fully qualified engineering teacher. It is obvious that when subsequently attending a complete engineering course at a technical college the student will receive in fuller and sounder measure such instruction as part of the regular course covering all, and more than all, he could have possibly received in a secondary school; and, moreover, there is a real danger, which has been actually experienced, that certain methods and ideas included in certain school courses may have to be corrected, if not eradicated.

Technical Training

Passing now from the preliminary but important school work to the subsequent professional training, there is much division of opinion among engineers and engineering teachers as to the position which workshop training should occupy in relation to the more purely technical training of the student. Many engineers and engineering teachers are of opinion that practical experience on the works or in the factory of an engineer should be gained before taking up an engineering course at a technical college. They argue:

1. That works experience is necessary to enable the student to take full advantage and realize the importance of his studies at an engineering college.
2. That it does not follow that a man who has first passed through the technical college will necessarliy make a successful engineer, the works training under practical conditions being, it is asserted, the best test for his fitness.
3. That the student trained in the technical college does not, after his college course, take kindly to the manual labor in the shops necessary to complete his experience, and that when he passes into the works as a workman he finds a greater difficulty in raising himself afterwards to a position of responsibility than one who has obtained works experience first and technical training afterwards.

There are, however, other well-known engineers (and engineering teachers) who are of opinion that the above views are too often based on an imperfect knowledge of what a really good college course in a modern and up-to-date technical college can accomplish, especially if it be combined with practical experience in works judiciously introduced at the proper period when the early stages of engineering training have been sufficiently developed to prepare the student to assimilate the experience of a commercial workshop more rapidly. Such systems of engineering education are now known as "Sandwich" systems, and as long ago as 1903 a pioneer system of this type was adopted at the Northampton Polytechnic Institute, after a careful and exhaustive inquiry into the details and the results of the various systems of engineering education then in being in the chief countries turning out good engineering work. In organizing, planning, and carrying out the necessary instruction courses, the principal, who introduced the system, has received the loyal co-operation of his colleagues on the staff; and it is to this co-operation that the success attained is due, and what immediately follows is based upon the experience so gained, and not upon mere educational theory.

It is, therefore, submitted that engineering training in a well-staffed and well-equipped technical college should be started directly the student leaves the secondary school, and that for this purpose, as college sessions begin at the end of September, he should leave school not at Christmas or Easter, but only at the end of the summer term in July. As already mentioned, it is considered in some quarters desirable that a student, on leaving the secondary school, should go straight into a works for, say, a year, in order that it may be ascertained whether he has any aptitude for engineering training. There is, however, a good deal of evidence to support the opinion that aptitude for engineering training can be more readily and quickly tested in a well-organized technical college, staffed with men who have been through the works, than it can in the works. The question is, to some extent, one of "lost time." In the works weeks, if not months, must inevitably be lost before the student begins to understand in any educational sense what is going on around him. On the other hand, if he goes straight to the technical college his education is continued without a break being very apparent. In fact, one of the difficulties in a modern technical college is to make the first-year student realize that he is no longer at school, and that his professional work has commenced, and further that the greater freedom of college conditions which he is quick to take advantage of is accompanied by a correspondingly greater amount of individual responsibility.

For admission to the college the student should be required to pass an entrance examination if he has not, as he should have done, passed an examination qualifying for admission to a university before leaving the secondary school. But such an entrance examination and even the university matriculation should be regarded as merely indicative, and not as the actual test of the candidate's aptitude for an engineering career. The real entrance examination in a technical college is the work of the first term, or of the first session, and during one or other of these periods the trained staff is capable of answering very definitely the question, "Should the engineering training be continued?" If the answer be in the negative, the training should be dropped not later than the end of the first year, and the student should devote his energies to some other training more in accordance with his natural bent. If, however, it is decided that failure in the first year is due merely to a student, as is sometimes the case, failing to realize his responsibilities and opportunities, he should be given another opportunity of facing the first year's work.

As to the kind of training specially suitable for aeronautical engineers, the authors make no apology for basing the schemes which they put forward upon the experience of the teaching of aeronautics gained at the Northampton Polytechnic Institute, at which pioneer courses were started in September, 1909. This experience is combined with their experience in the successful training of engineers in other branches of engineering which has been referred to above. Detailed syllabuses and time-tables are set forth in Appendices I and II, and in the following remarks reference is made to these.

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* Lecture delivered before the Aeronautical Society of Great Britain.

No distinction is made in what follows between the professional training of engineers in the universities and in technical institutes. In both cases the training is essentially the same for all students who are commencing their training and for all students up to the standard of a first, including an honors, degree at the university. As a matter of fact, throughout the country the association of the larger technical institutes with the universities is very close indeed. In London the principal teachers of engineering, in the more important of the polytechnics which prominently deal with engineering, are members of the Boards of Studies in Engineering at the university, and these institutions are recognized under the university statutes for training internal students. In Manchester the association is even closer, the Municipal School of Technology being a part of the university for all effective purposes. Similar associations exist elsewhere, but in accordance with our time-honored English plan of doing these things, they differ in detail in almost every instance.

The chief function of a technical college in this connection is obviously to train real engineers and not merely to train university graduates, but if the university curriculum is properly drafted, the two curricula cannot differ very much up to the honors standard of a first degree. Where the university work in the future should be most differentiated from that of the technical colleges should be in the greater leisure and opportunities for post-graduate research, though, as is well known, such research is by no means neglected at the foremost technical colleges, and the point is dealt with later. In this connection a cordial vote of welcome may be given to the munificence of M. Zahkaroff on his gift, through the British Government, of 25,000 pounds sterling to the University of London for the foundation of a chair in aeronautics.

For the purposes of this paper it will be convenient in taking up the details to separate that part of the college training which is not specially aeronautical, but is common to other branches of engineering, from the part which is more particularly required by aeronautical engineers, and which would not, as a rule, be taken by other engineering students.

The Necessary College Training Not Specially Aeronautical

It is not clearly understood by some aeronautical engineers and by many others that a sound preliminary training in general engineering principles similar to that outlined in the Northampton Institute syllabuses for first and second year day students is required before any reasonable progress can be made with the higher studies in aeronautics, or even of any studies in aeronautics distinctively so called; and further, that concurrently with the specialized instruction in aeronautical engineering following such a preliminary training much higher instruction work in mechanical engineering is required. For instance, it is essential that the student's mathematical studies shall continue through each year while attending the technical college, the standard of knowledge attained being the same as for other departments of engineering, and including a good working knowledge of the differential and integral calculus and of higher mathematics generally.

The course outlined is intended to cover four ordinary educational sessions from the beginning of October in the first year to July in the fourth year. In this period the second and third summers, from April to October, are to be spent in commercial workshops, with only such works holidays as falls within these months.

The first session's work is based upon the assumption that the prospective student has attained the well-known standard set for the matriculation at the University of London, either in a general examination or through the senior school examination. This insures a fair knowledge of elementary mathematics, the power of expression in English, a knowledge of one language and some knowledge of a science from which it is hoped that the student has acquired some idea of scientific methods. So as not to exclude latent engineering talent, however, some students are admitted on a designedly lower entrance standard in view of the rigorous application of the plan set forth above of treating the whole of the first year's work as an extended entrance examination.

The first session's work is devoted to a thorough grounding in mathematics, pure and applied, physics and chemistry, with the addition of engineering drawing and elementary engineering design, such as is required by all engineers, civil or mechanical. It is during this period that the ineligibles and the slackers are weeded out, rather than at the entrance examination, at which some of the students on the border line for passing can therefore be admitted as probationers, to give them a chance of showing whether they are likely to be successful in the later courses.

Special technological training begins with the second session, which, as already explained, is a two-term session, at the end of which works experience, lasting from Easter to October, is to be started. Distinct specialization begins from the time the student goes into the works at Easter of this second session, and from that time onward the aim is to train him very specially in some main branch of engineering, in this case in aeronautics, while giving him a good knowledge in other branches. It must be understood that in these later years, notwithstanding early promise, a particular student may show that he is unable to assimilate the highest training offered. In such a case it will be advantageous to transfer the student to the works when he has reached the limit of the college training he is capable of absorbing, and which will undoubtedly be a great advantage to him in his subsequent work.

Time-tables for these two sessions of general training are given in Appendix II, but as detailed syllabuses are not given in Appendix I a few remarks may be made upon the scope of the work in the various subjects at this stage.

In mathematics the aim throughout is to train and develop the student's mathematical faculty (which if poor or entirely lacking will disqualify him from dealing with advanced problems in engineering) in such a way that ordinary mathematical processes in algebra, geometry, trigonometry, and the differential and integral calculus become working tools, to be almost unconsciously used as a matter of habit.

The physics in the preliminary course is treated with the distinct purpose of qualifying the student specializing in aeronautics later on to deal readily *inter alia* with the theory and practical calculations of aero-engine cycles, to grip the principles and details of magneto ignition and other electrical devices carried by aircraft, and to understand their observational equipment, etc.

The special study of aero engines must obviously be preceded by an outline study of heat engines generally and of heat engine cycles, particularly those dealing with internal combustion engines. The fundamental principles of hydraulics and pneumatics, as well as of meteorology, call for special study during the preliminary work at a properly organized course of instruction in aeronautics.

During this preliminary course the student also acquires a knowledge of the principles of chemistry sufficient, at least, to enable him to deal effectively, when taking the higher and more specialized work of the advanced course, with the necessary calculations on the combustion of fuel, and particularly of gaseous feuls. His laboratory training includes the use of gas analysis apparatus and the analyses of exhaust gases from internal combustion engines.

His preliminary studies of engineering materials, from the chemical as well as the mechanical point of view, are designed to enable him to understand the importance of a chemical analysis of the material and of the influence, beneficial or deleterious, of small percentages of certain chemical elements on the properties of the material for resisting static or kinetic stress and on the elasticity and resilience of the material.

Aeronautical drawing and design obviously cannot be properly dealt with until the student has first mastered the elements of geometrical and mechanical drawing and made himself familiar with drawing office methods. This preliminary training, therefore, is dealt with before attempting any specialization in aeronautics. In the courses and time-tables given in Appendix II provision is made during the first session for giving a thorough grounding in these essentials, and it is unnecessary in a paper of this kind to give a syllabus of the kind of preliminary work in this connection. It is too well known to require specification.

And last, but not by any means of least importance, some attention must be given to the business or commercial side of engineering. How often has it been said by the employer, "Yes, So-and-So is excellently trained in engineering theory and is fairly good as a designer, but in business matters he is a baby, and not to be compared with men in my works who, though they may not be good at theory, know and can deal with the bearing of their work in relation to £ s. d. It is a pity that the technical schools cannot give some attention to their work in its business aspect." Even in the preliminary work, therefore, this aspect must not be overlooked, though its formal treatment belongs more properly to the specialized work of the third and fourth sessions.

The College Training Specially Aeronautical

This special training, as already explained, is dealt with in the third and fourth sessions' work, for which the time-tables will be found in Appendix II. For the special subjects appearing in these time-tables detailed syllabuses will be found in Appendix I, but in view of the relevancy of these subjects a few general remarks will not be inappropriate here.

The theory of machines and of mechanism, to lead up to which a good knowledge of mechanics is provided in the first two years, form a special feature of the advanced work in direct relationship to many practical problems, such, for example, as the inertia effects of moving masses, whether free or constrained, as in the primary and secondary balancing of engine parts. In this connection the gyroscopic effects on the machine, due to rotation or turning, in the engines, mechanism or propeller, and also the machine itself, are fully dealt with.

The advanced design work for aircraft prime movers necessarily involves the advanced theory of heat engines, modified by practical considerations and experience, together with mechanical design based on a full knowledge of the strength, elasticity, fatigue and durability of materials.

More advanced work than can well be included in preliminary courses is therefore given on the strength, elasticity and fatigue of materials, and proceeds concurrently with specialized instruction work in other subjects of aeronautical engineering. The effects of fatigue on the various parts of an aeroplane structure due to repetitions and variations of stresses does not yet appear to have attracted serious attention in connection with aeroplane work, and no doubt some disastrous failures of machines are due to such effects.

The advanced drawing office work in aeronautics consists in applying the general principles and experimental data for aircraft to the design of the details, the chief parts of the machine, and, finally, the full structure, with provision for more advanced design for students who wish to specialize in some particular section of the work; *e. g.*, engines, or propellers, or fuselage.

Very little has as yet been properly standardized for the constructive details, or even for the full machine, and each manufacturing firm is, to some extent, a law unto itself. This is, of course, inevitable from the nature of the case. Only a very limited amount of standardization would at the present time be of any value, for the design work for aeroplanes is in such a state of flux that parts have to be designed and redesigned over and over again before anything final for a particular machine can be arrived at. After each design it becomes necessary in many cases to subject the built-up product to experiment or test in the laboratory and workshop, with the result that more often than not redesign is necessary. For example, unexpected weaknesses may be revealed under test in some part of a joint or clip, so serious as to render the greater part of the design useless until the defect is remedied by a modification of the whole design.

This being the present state of things in relation to aeronautical design, it follows that at the technical college testing in many cases should follow preliminary designs so as to arrive at a design distinctly good for the purpose it is intended to serve.

Too much must not be expected from the trained product of a technical college in this respect. As remarked more than once, the profession of aeronautics is a new one, and at present subject to ever-varying change. A vast amount of experimental work has yet to be done, new ideas which are at present only dimly emerging have yet to be tried and new materials and combinations of materials have yet to be put to the test of actual utilization. The manufacturer must be satisfied if the technical college gives him a trained intelligence under the guidance of a sound, common sense—in short, a man who is well versed in the fundamental principles of aeronautics and who can apply his knowledge to a reasonable extent in both experiment and design.

Laboratory work, especially of such a highly technical type as is necessary in the education of aeronautical engineers, does not lend itself in the same way as lecture work to the precise synoptical specification of a formal syllabus, and therefore no laboratory syllabus is set out in Appendix I. The scope and range of the work recommended will be better gathered from the following remarks.

In attempting, however, to give even an outline of some of the essential experimental or laboratory work one is brought face to face with the kind of difficulty necessarily experienced in dealing with a new industry or applied science, and in endeavoring to organize the educational work relating thereto, so as to give both the systematic instruction in the fundamental principles underlying that industry and to stimulate ideas for future developments.

(*To be continued*)

CURTISS MODEL HS-1 FLYING BOAT

THE Model HS-1 flying boat, built for coast patrol work, was tested out in a trip from Buffalo to Detroit and return on July 24th. No attempt was made for speed. The new 200 h.p. Curtiss V-2 motor worked perfectly throughout the entire trip. When nearing Buffalo a heavy fog was encountered, compelling the pilot to fly rather low so as to follow the American coast line.

The boat was piloted by Harold Kantner, with Wallace Buch as passenger. The start at Buffalo was made at 9:15 in the morning. The Toledo Yacht Club was reached at 1:05 and a stop was made at the Detroit Motor Boat Club at 6 o'clock. On the return trip, a start was made at the same time as the previous day (9:15). A strong head wind was encountered most of the way, but the machine arrived at Angola, on the outskirts of Buffalo, at 2:40 in the afternoon.

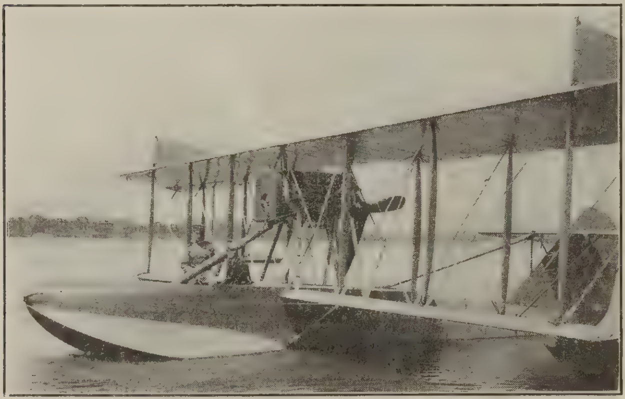
Specifications of the Model HS 1 flying boat, and performance results which were made from actual flying tests, are as follows:

General Specifications

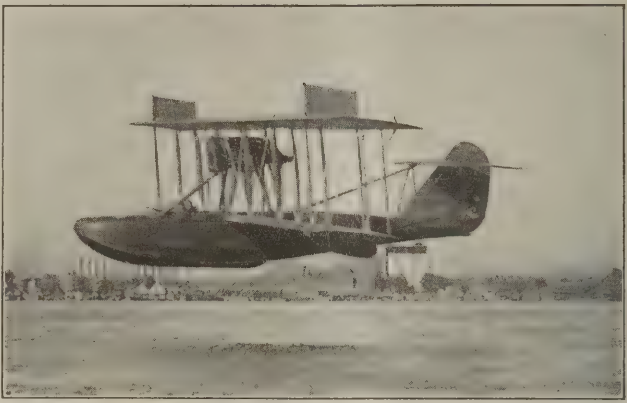
Wing span—upper plane	59'4"
Wing span—lower plane	45'8"
Depth of wing chord	75 1/16"
Gap between wings	90"
Stagger	none
Length of machine overall	38'6"
Height of machine overall	14'3"
Angle of incidence	4 deg.
Dihedral angle	none
Wing curve	R. A. F. No. 6

Areas

Wings—upper	370 sq. ft.
Wings—lower	256 sq. ft.
Ailerons	54 sq. ft.
Rudder	25 sq. ft.
Elevators	29.9 sq. ft. each
Vertical stabilizer	34.9 sq. ft.
Horizontal stabilizer	63.9 sq. ft.
Loading (Weight carried per sq. ft. of supporting surface)	6.7 lbs.
Total supporting surface	626 sq. ft.



The Curtiss Model HS-1, which was flown from Buffalo to Detroit by Harold Kantner.



The Curtiss Model HS-1 in flight over Lake Erie, making a speed of 76 miles an hour.

Weights

Net weight—machine empty	3215 lbs.
Gross weight—machine and load	4205 lbs.
Useful load	990 lbs.
Fuel—100 gallons	610 lbs.
Oil—8 gallons	60 lbs.
Passenger	160 lbs.
Pilot	160 lbs.
	990 lbs.

Performances

Speed—maximum	73 M.P.H.
Speed—minimum	52 M.P.H.
Climbing speed	500 ft. in 3 minutes

Motor

Model	Curtiss V-2-3, V type, 8 cylinders
Horse power (Rated 1,400 r.p.m.)	200
Weight per rated h.p.	3.45 lbs.
Fuel consumption per hour per brake h.p.	.54 lbs.
Fuel tank capacity	100 gals.
Oil tank capacity	8 gals.

Propeller

3 blade	Curtiss No. 2607
Material	Mahogany
Pitch	4'9"
Diameter	8'0

(Continued from page 777)

nacelles between the wings. The radiators are in the nose of the nacelles, as are also, in contradistinction to the Gotha, the air screws. The fuselage, which has seating accommodation for three occupants, projects a considerable distance ahead of the main plane.

DIMENSIONS AND EQUIPMENT OF THE LATEST GERMAN AEROPLANES

Machine.	Type.	No. of Seats.	Span.				Gap.		Chord.		Length Over All		Motor.	Total h. p.	No. of Guns.	No. of Bombs.
			Upper.		Lower.											
			ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.				
Albatros	D. II	1	27	8	26	3	4	2	5	3	24	0	Mercedes	175	2	0
Albatros	D. III	1	29	6	28	8	4	10	4	10	24	0	Mercedes	175	2	0
Torpedo	D	1	.....		.....		.....		.....		.....		Mercedes	175	2	0
Roland	D. II	1	29	6	28	0	4	4	4	9	22	6	Mercedes	175	2	0
Halberstadt	D	1	28	6	25	9	4	3	4	10	24	0	Mercedes or Argus	120	2	0
Fokker	......	1	29	6	29	6	4	3	4	10	24	0	Mercedes or Oberursel	175	2	0
Rex	D. II	1	.....		.....		.....		.....		.....		....	...	...	...
Roland	C	2	33	0	33	0	4	0	5	3	.....		Mercedes	175	1	...
A. E. G.	C. IV	2	42	6	41	0	6	2	5	5	23	6	Mercedes	175	2	4
L. V. G.	C. IV	2	44	6	.....		.....		6	5	28	0	Mercedes	235	2	4
D. F. W. Aviatik	C. V	2	43	6	42	0	5	6	5	9	.....		Benz	228	2	6
Albatros B. F. W.	C. V	2	41	3	40	0	5	10	5	10	28	0	Benz	225	2	4
Rumpler	......	2	.....		.....		.....		.....		.....		Mercedes	260	2	6
Gotha	G. I	3	78	0	72	0	7	2	7	6	41	0	Two Mercedes	520	3	14
A. E. G.	......	3	.....		.....		.....		.....		.....		Two Benz	450	2	.

REPORT OF THE ACKERMAN AEROPLANE WHEEL TESTS

Reports have been made up by the Canadian Aeroplanes, Ltd., Toronto, Canada, and by the Bureau of Standards, Washington, D. C., showing the shock-absorbing qualities and resistance to breakage of the Ackerman Aeroplane Wheel. The object of the test at Toronto was to determine the effect of a swinging side blow applied to the rim of a 26-inch by 4-inch Ackerman Wheel.

The tests were made as a swinging pendulum and not as a falling weight, and that weight was started from a point six feet from the striking point, and the length of the pendulum was such as to raise the weight two feet from the floor. Therefore, the weight travelled a swinging distance of 6.3648 feet, swinging through with the acceleration due to gravity, attains a speed of .552 feet per second, or 33.2 feet per minute, and the weight equaling 1,500 pounds, the striking energy would be 1,500 by 33.2—49,800 pounds.

L—Length of pendulum in inches.
T—Time of one acceleration.
G—Acceleration due to gravity.
W—Weight of pendulum.
F—Force expanded.

$$\frac{F—T\ VL\ WVG}{6.25}$$

①

②

③

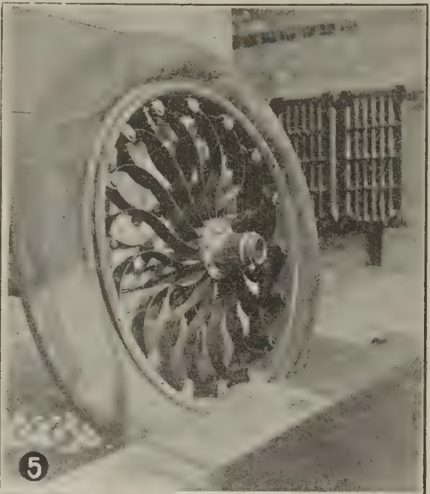
④

The wheel to be tested was mounted on an axle firmly fastened and braced to the bottom of a box capable of holding about one ton of sand in bags.

The apparatus was slung by two cables in such a way that the weight from the floor could be slightly varied by means of turnbuckles. A cleat of wood 4½ inches high (of sufficient height so that when the wheel was swung against it, the rim of the wheel, and not only the tire, would strike it at the lowest point of the swing) was firmly fastened to the floor and braced so as to prevent any movement of the cleat, as far as possible. The box could be pulled back by means of ropes to any desired position and suddenly released by means of a trigger catch.

The box was loaded with sand so that the total swinging weight (wheel box and sand) was 2,000 pounds. The weight of the box and wheel being determined by spring balance, and the sand weighed (in bags) on a platform scale.

For the first test the box was slung so that the tire, pumped hard, just rested on the floor, and against the cleat; it was then swung back until the lowest point of the tire was 12 inches above the ground and released. The tire struck the ground about a foot in front of the cleat, and then the wheel struck the cleat, causing a slight permanent deformation of the wheel.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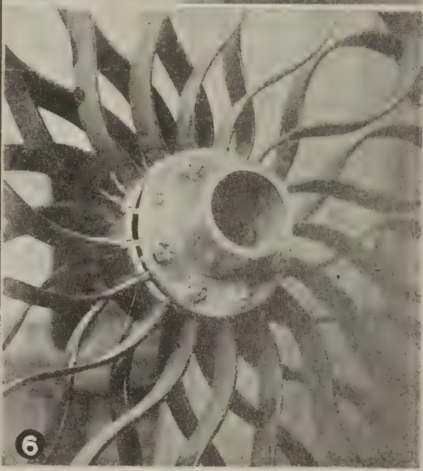
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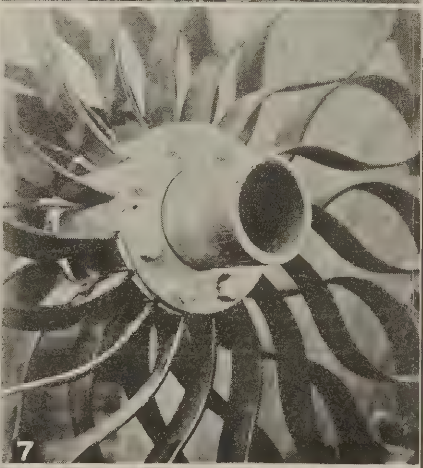
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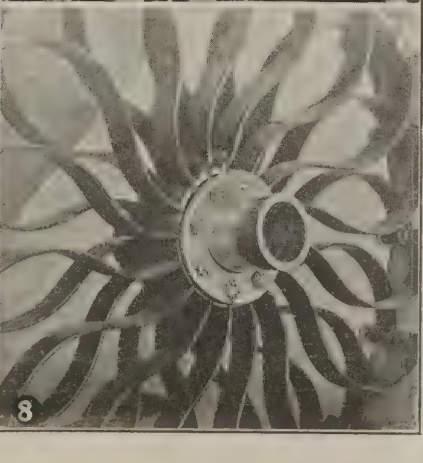
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The velocity at the moment of impact against the cleat (neglecting the retarding effect of the wheel dragging along the floor), would be

$$V = 2GH \text{ where } H = 1 \text{ ft. } G = 32.2$$
$$= 8.02 \text{ ft. per second}$$

The K. E. of the swinging blow (using this value of B) would be =

$$\frac{1}{2}\ MV2 \text{ where } M = \frac{W}{G} \text{ \& } W = 2{,}000 \text{ lbs.}$$
$$= \frac{1}{2} \times \frac{2000}{32.2} \times 64.4$$
$$= 2{,}000 \text{ ft. pounds}$$

The K. E. of the blow against the cleat would be somewhat less than this, owing to the retarding effect of the tire dragging on the floor.

In the second and final test the box was raised slightly so that the tire would just not touch the floor at the lowest point of the swing before the wheel struck the cleat. The box was pulled back until the lowest point of the tire was 10" above the floor and released, the wheel having been turned around 180°, so that the part of the rim that struck the cleat in the first experiment, was now uppermost.

The force of the blow was sufficient to cause the wheel to mount the cleat, and in so doing the tire was partially pulled off and the valve stem cut, causing the inner tube to burst at the point.

The wheel was permanently deformed about 2" (measured at the rim), the hub was distorted and cracked, one of the retaining bolts broken and two of the spokes released from their anchorage in the hub. See photos 3, 4.

The K. E. of the blow in this case $= \frac{1}{2} MV^2$

$$V = 2GH \text{ where } H = 1\tfrac{1}{2} = 32.2$$
$$V = 9.82 \text{ ft. per second}$$
$$M = \frac{W}{G} \text{ where } W = 2000$$
$$K.\ E. = \tfrac{1}{2} \times 96.6 = \text{ft. pounds.}$$

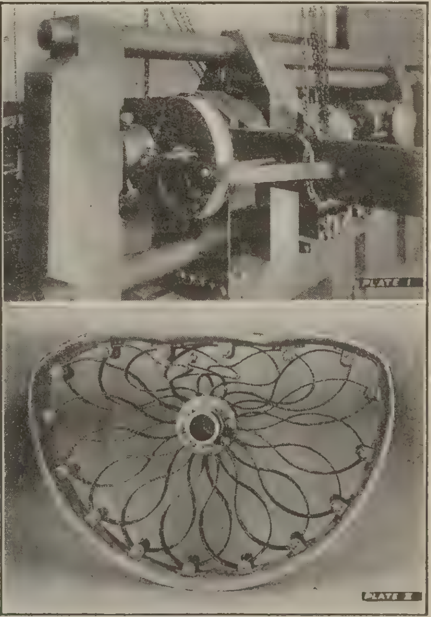
The report to the Ackerman Wheel Co. of the test made at Toronto was accompanied by a letter from Mr. F. G. Ericson, Chief Egineer of the Canadian Aeroplanes, Ltd., saying:

"I herewith beg to submit report of test made on one of your wheels—the 26 × 4 Spring wheels, and I also enclose eight (8) photographs taken during the various stages of the test. I am pleased to say that none of the spokes show even the slightest crack.

We intend to make a similar test on the Standard 26 × 4 Wire Wheel, as soon as time allows, and will be glad to let you know the comparative result. We are at present building a special Landing Gear fitted with two of your 26 × 4 Spring Wheels, and same is to be attached to a JN4 Training Machine for use at Camp Borden Aerodrome.

Yours very truly,
(Signed) F. G. ERICSON."

(*Continued on page 785*)



Plates I and II, showing the testing apparatus and the result of the test at the Bureau of Standards, Washington, D. C.

ITALY'S GIANT AIR CRAFT SMASHED POLA

IN connection with the description of the large Italian machine which we recently printed in AERIAL AGE, the following dispatch by Perceval Gibbon to the New York *Times,* is very interesting:

Italian Headquarters, Aug. 5—The Italians are launching against the Austrian naval port of Pola vast and startling flights of giant Caproni airplanes, each with a crew of four or five men, and as if to place upon the enterprise the final cachet of Italian perfection, with each raid there travels in the leading machine the single man whose words and gestures are followed breathlessly throughout the country, Gabriele d'Annunzio, the acclaimed poet of the Italians. The Austrians, too, have been raiding lately, sprinkling bombs on many inland villages far from military objectives.

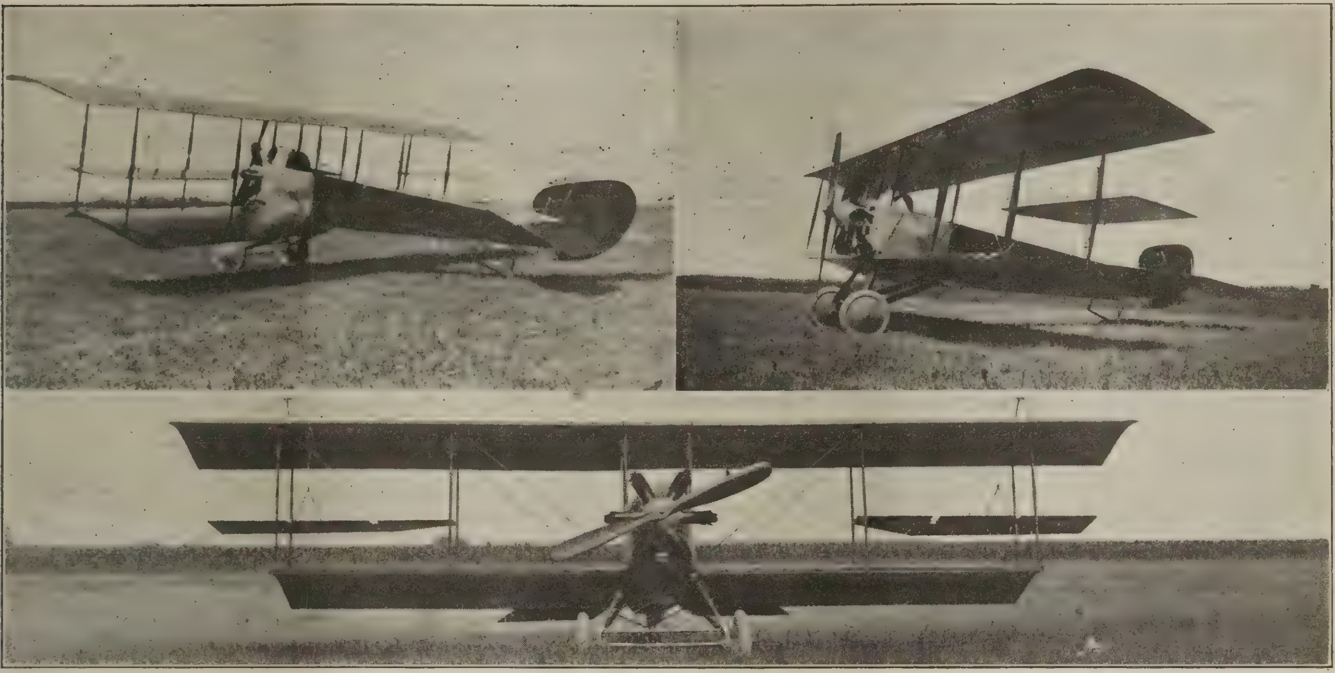
The Italian raids upon Pola during the nights of Aug. 2 and 3 were not merely reprisals for many useless murders, but an assault upon the nest of submarines, airships, airplanes, and war vessels with which Austria seals the entry to the Gulf of Trieste. The results, which are yet to be confirmed and tabulated, are surely great. I have heard the statement of an aviator who took part that Pola as a naval base is already extensively damaged.

The first raid was carried out by thirty-six machines, including fast fighting machines, which escorted the great Caproni bomb droppers. It was like watching a flotilla of destroyers go to sea as the great machines moved off at four-minute intervals, taking up a perfect alignment against the sky. Motor-boats were out to guide them to the Austrian coast, for there was a fog over the sea. Before midnight the squadron was over Pola, maneuvering amid a tangle of searchlight beams and a hurricane of shots from panic-stricken gunners in the city's defenses. Bombs ranging from 70 to 200 pounds were raining down on the arsenal, dockyard and anchored ships.

Three waves of airplanes went over, and the first two saw a huge explosion in the arsenal and a great fire start up, either in the arsenal or in the submarine depot. Six and a half tons of bombs were dropped in all, and there would have been more but that the third wave of attackers failed to find purely military targets.

The following night they again returned to the attack. This time a light fog favored the aviators and eight tons of explosives were deposited where they were likely to do the most damage. The results were well observed and are described as entirely satisfactory. I must await the precise details, but I hear on all hands that these will be startling.

Views of the interior of the Pomilio Aircraft Factory in Italy



ROBINSON MOTORED TIMM TRACTOR

Mr. Otto W. Timm, who has been doing exhibition work for five years, has just completed, at his shops in Grinnell, Iowa, the new looping tractor here illustrated. It is said to be capable of great speed and rapid climb. On the third trial flight, Mr. Timm looped five times, and was surprised at the small loops it was possible to make with this machine.

General dimensions are: Span of upper plane, 33 ft.; lower plane, 26 ft. Gap, 5 ft. and chord 5 ft. Length of fuselage, 15 ft. Landing chassis, V-type, with 26 by 4-inch wheels. The motor is the latest 100-h.p. radial Grinnell Robinson.

The normal speed of the motor, with an 8 ft. diameter propeller with 6½ ft. pitch, is 1420 r.p.m., and it is possible to fly the machine with the motor throttled down to 870 r.p.m. The net weight of the machine is 850 pounds.

LATEST LIST OF AVIATION "GROUND SCHOOL" GRADUATES

The aviation "ground schools," where preliminaries to instruction in actual flying are taught, are now turning out classes each week. After their courses in these "ground schools" the men go to a flying school, where the reward of successful work is a commission. The men graduated in two classes most recently reported to Washington are as follows:

Cornell University School

Heyliger Church, Kenneth G. Collins, Sherwood Hubbell, Spencer H. Kerr, Malcolm W. McAlpine, Russell R. McCormick, Oliver B. Sherwood, Algernon R. Clapp, Bradley J. Gaylord, Edwin M. Welch, Thomas C. Simms, Ruford C. Franklin, J. W. Geary, Alexander H. McLanahan, W. K. Norton, Alton A. Broady, Clarence A. Brodie, Charles S. Chase, Joseph M. Johnson, Harvey K. Leonard, William R. M. Long, Stuart E. McKeown, James E. Meredith, Harry A. Miller, Emil H. Moltham, Wilbur D. Mong, George Perkins, Everett Banie Powers, Harold Rowe, Charles B. Sands, Warren C. Eaton, P. W. Fitzpatrick, R. A. Floyd-Jones, A. Wallace Gibson, Alfred Lawson, Robert G. Macks, G. L. Mentley, Sydney C. Thompson, P. C. Wanser, L. E. Wenz, Morton W. Wickersham, Frank D. Snell, Edward M. Urband, Lawrence J. Willinger, Alfred C. Cooper, W. L. Davidson, Frederick L. Koons, Willard W. Lauer, Raymond Mooney, Bennett Oliver, Franklin N. Platt, Harold W. Vassar, Samuel J. Walker, Jr., L. W. Wheelock, Jr.

University of California School

Robert P. Elliott, William W. Lovett, Jr., Harold W. Thayer, Edward S. Waterman, Wilbur E. Oliver, N. S. Fairchild, William E. Karns, Carroll V. Stein, Daniel E. Ellis, Chares I. Preston, Samuel W. Terry, Louis A. Woitishok, Allen S. Fladd, James L. Kinney, William A. Koppe, Charles E. Lloyd, John W. Sharpnack, Leopold E. Kinn, George W. Benedict, Frank M. Bartlett, Maurice J. Cleary, Albert E. Calvin, Harold R. Kelly, Robert B. McGill, Alexander H. Munro, Rutledge B. Barry, Thomas Belsjoe, Allan F. Bonnalie, William J. Foy, Earl N. Hammer, Robert D. Hikely, Leslie B. McNerty, Jr., C. Thomas Nathan, Glen M. Pike, James B. Rogers, Jr., John A. Cannon, Thomas E. Graves, Harry B. Hartman, Earl S. Hoag, William A. Hoff, Wesleyan J. Hunt, John B. Jaqua, Thomas J. Lenihan, David C. Logg, Ernest A. Love, Theodore B. Lyman, Charles H. Monroe, William K. Norton, Walter F. Perkins, Jr., George S. Peterson, Dache M. Reeves, Harry J. Rowe, Edward W. Raley, Charles P. Tyrrell, Earl P. Stewart, Harry A. Sutton, Roy E. Wales, Edward N. Walsh, Jr., Edward L. Williams, Jr.

University of Texas School

Henry D. Clay, William S. Cousins, Lindley H. De Garmo, Herbert M. Mason, Thomas F. Mooney, George D. Selden, Joseph H. Sublett, Grover C. Vaughn, Paul S. Williams, Wendell A. Robertson, H. F. Tittman, Jr., Raymond C Taylor, Virgil Hine, John P. Sparks, Samuel W. Harkins, S. S. Kaye, Jack Brackett, Charles G. Gaines, George C. Whiting, Moxie Anderson, William A. Brown, Roy Carter, Arthur L Foster, Willis N. Gray, Berry T. Greenwell, Leland R. Hewitt, Charles B. Johnson, Stuart D. Simonton, Edgar L. Smith, Herman Fred Krueger.

Massachusetts Institute of Technology School

William A. Adams, Rex P. Arthur, P. R. Babcock, William F. Baker, F. D. Bell, L. G. Bernheimer, B. F. Beverly, M. Blumenthal, R. F. Chaplin, A. L. Clark, Harold A. Clark, F. P. Clement, jr., F. W. Cowles, George M. Crawford, John H. Enterkine, H. H. Gordon, H. S. Houghton, George H. Hull, Nelson C. Hyde, George C. Kenny, S. S. Batchelder, W. L. Deetjen, Charles T. Evans, jr., A. C. Rothwell, Samuel G. Fitzsimmons, C. McDonald, P. H. McNulty, Otto Melamet, D. H. Manchester, R. B. Messer, R. C. M. Page, J. Perry, Garland W. Powell, T. C. Pray, T. J. Quinlan, H. I. Riley, J. H. Schooler, K. O. Shrensbury, T. A. Simons, Frank D. Soule, F. H. Van Horn, John B. Weir, G. R. White, F. V. Yates, George H. Hull, Richard Mortimer, jr, Stuart C. Welch, Edward N. Willcox, R. P. Baldwin, George A. Beach, D. D. Harries, H. M. Hoyt, C. C. Prince, G. W. Wheeler, G. D. Woods, C. R. Godman, Frank J. Howard, Walter B. Mather, J. S. Richardson, jr., L. C. Slutz, C. E. Wright, Robert J. Barron, J. F. Brown, G. H. Fisk, John Mitchell, T. E. P. Rice, R. H. Rowe.

University of Illinois School

Walter Avery, Ben. Brown, George C. Dorsey, Harold Gile, David R. Jones, D. Knight, Reed Landis, J. A. Roth, F. S. Whiting, Paul S. Winslow, George L. Erwin, jr., Frederick H. Morlan, William W. Palmer, Ralph C. Searle, Powhatan H. Clarke, G. Gill, Alexander F. Hoagland, Keith Jones, Lawrence Kinnaird, George P. Hull, J. A. Maloney, Gardiner V. Manley, Wayne H. Moore, William H. Vaill, Walker K. Young, Wm. H. Cheney, John Fr. Seerley, Paton MacGilvary, and Le Roy D. Kiley.

Ohio State University School

Harold Ainsworth, Harold A. Barton, Alfred E. Bennett, David Gregg, William N. Hewitt, George S. Patterson, Winfred E. Sissnor, William D. Tipton, John W. Welch, Errol H. Zistel, George L. Bateman, T. S. Cox, R. H. Dwiggins, Fred. Feasel, Ridgeley Fisher, Howard G. Mayes, F. M. Ring, Doyen P. Wardswell, Arthur E. Crispin, Maurice A. Sharp, John G. Miller, Victor H. Strahm, Q. V. Clemens, James P. Hanley, jr., Homer W. Johnston, John Lowman, Philip C. Goetell, Roscoe R. Hough, William C. Huber, J. M. Johnson, Roy G. Miller, William A. Munn, P. M. Neal, Forrest H. Neely, M. K. Palmer, Hugh C. Power, John Stone, Otis H. Williamson, Jacob M. Woodward, W. R. Wright, George M. Comey, Charles W. Drew, Harold F. Evans, John G. Layton, Harry S. Manchester, J. Park, Wm. H. Potthoff, Albert J. Weatherhead and Melvin B. Kelleher.

A HISTORY OF AVIATION

By CHARLES M. MANLY*

THE suggestions and sketches that Leonardo da Vinci made in his notebook about the year 1500 are probably the earliest record we have of serious attention being given to providing man with means of transportation through the air. But the great da Vinci apparently failed to see the fundamental feature of flight, whether of the bird or of the flying machine as it exists today.

It was Sir George Cayley who, about 1809, seems to have first analyzed the problem to the point of showing that flight comprised the double functions of sustentation and propulsion; that the act of flapping its wings was performed by the bird not as a means of directly sustaining itself, but for the purpose of propulsion; and that it was sustained by the aeroplane effect of its inclined wings being thus driven through the air.

In fact, it is of great interest to those of us here that Sir George Cayley was in reality the first aeronautical engineer. He not only formulated the laws of equilibrium and control, but actually demonstrated them by constructing and operating the first gliding machine. He made calculations from these experiments as to the amount of power required to carry a man, and suggested the burning of inflammable vapor in a cylinder as a means of securing a light-weight engine, when he found from computations that the newly invented steam engine of Watt was too heavy for his machine.

Many generations of mathematicians and physicists had been led astray in their calculations of the sustaining power of inclined planes by adopting the erroneous formula that Sir Isaac Newton had enunciated; he said that the pressure on an inclined surface was in proportion to the square of the sine of the angle, or only about one-twentieth of what it actually is. In fact, even so recently as 1830 a committee of the Institute of France, comprising the great mathematicians and physicists, Gay-Lassac, Flourens and Navier, presented to the Institute a report giving calculations made by Navier (based on Newton's formula, which he had implicitly adopted), and showing that a swallow in flight expended power at the rate of one-thirteenth of a horsepower. This report remained the standard authority on flight for many years. The profundity of the calculations seems to have obscured the absurdity of the result.

Before the middle of the 19th century, however, independent thinkers who had less knowledge of mathematics, but more common sense, followed in the footsteps of Sir George Cayley, and drew up plans for flying machines based on the principle of the aeroplane. In fact, Henson, in 1842, not only designed, but patented an aeroplane which, so far as the functions of sustaining and guiding itself were concerned, was thoroughly practical. The model machine on these plans that he and Stringfellow built in 1844 lacked two important elements; the one a matter of design—adequate means of preserving lateral equilibrium; and the other a matter of construction—an efficient and sufficient powerplant. He had a monoplane with horizontal and vertical rudders for steering up or down and sideways, and also there were two propellers. He had a small steam engine, but the arts had not advanced sufficiently to enable him to procure a boiler of a light enough weight for generating the necessary supply of steam. Stringfellow later, in 1846, built a new model with an improved engine, and in which the wings were made of curved or cambered surfaces. Wenham in 1866 patented the multiplane, or machine with superposed surfaces, thus giving us the present-day truss construction.

Invention of Ailerons

The thing that Henson lacked in his design was almost immediately supplied by Mathew Piers Watt Boulton, who invented the system of lateral balancing or control now so universally used; that of small supplementary planes, now called ailerons. The description he gave of these in his British patent was thorough and clear. It is the first record we have of appreciation of the necessity for active lateral control as distinguished from the passive lateral equilibrium secured by having the wings set at a dihedral angle. With this invention of Boulton we have the birth of the present-day three-torque method of control. The only thing then lacking to enable man to learn to operate flying machines was the one great organ—a suitable engine. Since there are only three directions in space, this invention of Boulton's not only was worthy of the illustrious name of Watt, to whom the world owes so much in connection with the steam engine, but also supplied the last element lacking for actively balancing or controlling an object moving through the air unrestrained in any one of the three directions of motion. Just prior to this, as already mentioned, Stringfellow had shown the advantages of curved surfaces over flat planes as regards the greater sustaining power and lesser resistance to propulsion.

The inventions of Henson and Boulton, erected on the ground work of the pioneer aeronautical engineer, Sir George Cayley, gave to the world as early as 1868 all the fundamentals of the flying machine of today—except the great life-giving element—the powerplant. It was indeed a harsh and cruel fate that deprived such enthusiasts as these of the glory of crowning their achievements with an actual demonstration of the correctness of their designs for constructing and controlling the operation of the flying machine. But the arts could not furnish at that time what they were able to do thirty years later—the internal combustion, or gasoline engine, of a light enough weight to furnish the power required.

During the twenty years following Henson's and Boulton's great work, the sporadic growth of aeronautical enthusiasts planned and schemed and finally prayed to the great goddess "steam" to give them their hearts' desire, and let them practise with their wings and controls. But steam was heavy and phlegmatic, and so busily engaged in rearing the great offspring of industrial, steamship and railroad industries to which she had given birth, that she heeded them not and let them instead receive the usual reward of the pioneer enthusiasts—the ridicule and scorn of the unthinking multitude, who can believe as possible only that which lies within their own limited experience or observation.

Early Research Methods

However, although the gibes and sneers of the heedless self-satisfied critics can delay progress, yet they can never kill the irresistible spirit or desire for achievement that is the heritage of the true pioneer. So, in the next few years following 1868, we find several notable men taking up the work where their predecessors had left it, each approaching it from a different point. Prof. Samuel P. Langley, then prominent as an astronomer of the newer school, had already made notable researches in the study of the sun; he quietly began researches on the subject of the sustentation of bodies by inclined planes moving through the air. In a way quite characteristic of his previous training and experience in astronomical work, he made his first researches not in trying to build some preconceived device, but in determining by actual test the fundamental data as to what the sustaining power of rapidly propelled inclined planes would be, what amount of power was necessary to propel them, and what efficiency of propulsion could be obtained from propellers acting on the air. When he had determined these data, the best advice he could obtain from engineers was that it was impossible to build a steam powerplant that would be of light enough weight for the purpose. He was so fascinated by the outlook, however, that he followed the counsel he later gave to me: where there is an object to be attained but no road apparent, make one; and the way to start it is to begin.

I will not tax you with the many years of patient but devoted toil and disappointment through which he passed. Only an indomitable spirit could have withstood it until finally the day of achievement arrived. On May 6, 1896, he saw one of his small machines, weighing 30 pounds, and carrying its own boiler and steam engine, fly for over half a mile, preserving its own equilibrium, and when the purposely limited supply of fuel was exhausted, settle on the water so gently that it was immediately returned to its launching device and made to repeat its initial performance. Having thus, by actual performance, demonstrated that mechanical flight was possible, he tried to leave to others the purely engineering problem of reproducing the results on a large enough scale to provide for carrying a pilot. However, the spirit of achievement would not let him rest, and two years later he started the construction of the large man-carrying machine that will be referred to later.

At about the same time, or somewhat later than Professor Langley started actual construction work on the earliest of his steam-driven machines, Mr. Maxim (later Sir Hiram Maxim), after making many tests to obtain data of his own, began the construction of his 350-h.p. machine at Llewellyn Park, England. This was a stupendous undertaking, and great credit is due him for the wonderful construction he produced, especially that of his powerplant. The problem of condensing the water was too formidable, however, even for so ingenious an inventor as Mr. Maxim, so that a suitable powerplant for a man-carrying machine was still lacking.

Somewhat later M. Ader built his originally designed machine, patterned to the last detail on the plan of a large bat. This he equipped with a remarkable steam powerplant, which could furnish 30 to 40 h.p. for several minutes without shortage of water. This was tried on the military parade ground at Satory, France, but unfortunately Ader had not utilized fully the work of his predecessors. On account of lack of proper control features, the machine was badly smashed in the tests after it had been off the ground only a few moments. As the machine was built with funds furnished by the French War Office, and the tests were secret, little was known of the machine until after it was broken, and the development of it ceased because of the withdrawal of Government support.

At about the same time that Langley, Maxim and Ader were developing their machines, Otto Lilienthal, an engineer by profession, was approaching the problem of actual flying from a different point of attack. He not only made careful tests of the lifting power and requisite power to propel inclined planes and curved surfaces, but, more important still, he took up the work of learning to fly (even though a mechanical powerplant was not available) practically where Sir George Cayley had left it. By persistent effort and practice, he became proficient in the art of gliding, using gravity as his motive power. Just at the time when he felt that his experience in gliding justified him in taking the next step and trying to equip a machine with a powerplant he had constructed, which, as it later proved, would have been too small for the purpose, he was killed in a last test he was making, after having executed almost two thousand glides without mishap. The results of his work, just as were those of all his predecessors and contemporaries, except that of Ader, whose work was for the War Office and therefore necessarily secret, were freely given to the public as rapidly as was consistent with ensuring their dependability before announcing them. As a result, that great patron saint of aviation, Octave Chanute, was inspired to continue them. It was really from the stimulation of his freely given counsel and experience that the Wright brothers, who, following in Lilienthal's and Chanute's footsteps, first practised the art of gliding until they became the peers of their preceptors. They took from the young automobile art the newly developed gasoline engine, refined it by decreasing its weight, placed it in their gliding machine, safely rode the air in repeated tests and were finally proclaimed the princes of the air.

Experimental Work with Langley

It was my privilege to be associated with Professor Langley as assistant in charge from 1898 till his work was brought to a close in 1904 through the lack of funds. Only shortly after he had begun his famous researches on the lifting power of inclined surfaces, he had become secretary and director of operation of the Smithsonian Institution at Washington, and it was there that he had carried on his great experimental work. In May, 1896, successful tests of his steam-driven machine demonstrated the practicability of mechanical flight. He was so firmly convinced that the securing of a suitable gasoline engine was the main problem involved that in 1898, before undertaking the construction for the War Department of a man-carrying machine with the funds allotted by the Board of Ordnance and Fortifications, he withheld actual acceptance of the funds until he had closed a contract for a suitable engine and a duplicate thereof, with what appeared to be the most capable and experienced gasoline engine builder in the country, who would undertake the work. This engine builder actually produced the parts of the engine within the three months allowed in the contract. They were strong and of light weight enough to give the 12 h.p. required for the 100-lb. weight allowed. Unfortunately, however, the engine could be made to develop only 4 h.p., and a year and a half were consumed and the engine builder became bankrupt in trying to make the engine function properly and give the required power.

In desperation, Mr. Langley and I went abroad in June, 1900, and sought the aid of every gasoline engine builder in Europe who it seemed might possibly produce the necessary engine. Our quest was in vain, for all of them told us that it was impossible to build an engine to give 12 h.p. with 300-lb. weight. Accordingly I returned to the States and, taking some of the parts from the engine here and building others, was able before the close of the year 1900 to get 17 h.p. with 120-lb. engine weight. This engine was somewhat of a patched up affair, so we built a new one with five cylinders of 5-in. bore and 5½-in. stroke. By the year 1902 we had this engine developing 52.4 h.p. continuously for ten hours, its weight being 125 pounds.

It seemed advisable to use this increased engine power and it was therefore necessary to strengthen greatly the shafts, gears and bearings used in delivering the power to the two 8-ft. propellers. As a result, it was the beginning of the summer of 1903 before we were really ready to make the long delayed tests of the man-carrying machine. In the middle of July, 1903, the large houseboat, which had been built as a hangar but which would hold the machine only when its wings were dismantled, was taken down the Potomac River to a point 40 miles below Washington. After many delays, largely due to the unusually inclement weather, the smaller or quarter-size copy of the large machine, which we had built and which was equipped with a similar five-cylinder engine weighing only 10 pounds and developing 3 h.p., was launched on August 8 from the top of the boat. The exhibition of complete automatic stability in the flight it made demonstrated that the larger machine ought to behave similarly when it was launched. After further delays the man-carrying machine was launched on October 7, 1903, the launching apparatus being similar in all respects to that used for the quarter-size machine. Unfortunately, however, the lower guy post of the large machine hung on the launching car and caused the front wings to be twisted so that they pressed down in front instead of lifting. The machine and I struck the water several hundred yards in front of the boat at an angle of about 45 deg. and at a speed of about 50 m.p.h. The wings were destroyed, but the frame and engine were uninjured except that the nose of the frame was bent owing to catching the guy post.

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* Paper read before the Buffalo Section S.A.E.

After bringing the boat with the machine aboard to Washington new wings were built and the machine was again launched from the boat at a point in the river near Washington on December 8, 1903. The wind was blowing so strongly that the tugs holding the boat were in danger of being foundered. The river was full of large cakes of ice, but as there was no more money available it seemed best to make a test at once. Unfortunately the strong winds and the swinging of the boat caused the wings and rudder of the machine to be broken as it dashed down the track, so that when released in space it had no rear supporting surfaces. The machine accordingly, under the full power of its engine, stuck its nose in the air until it was blown back and turned over as it struck the water. Though tangled in the machine under the water for over a minute and a half I managed to escape.

The ridicule of the public press had been most intense during the previous months and now became almost vindictive. As a result the Board of Ordnance and Fortifications refused to grant any further funds either to reimburse the Smithsonian for some twenty thousand dollars we had expended beyond the amount previously allotted or for continuing the work. A few months later I personally appealed to some prominent and wealthy business men of New York for funds to enable Professor Langley to continue the work, but as their decision was unfavorable we were forced to close up the work. I had constantly, though vainly, hoped that the work of a different nature that I was carrying on in New York would permit me later to give the time and money necessary to test the machine again. I wanted to demonstrate that it was the first machine ever constructed that was really capable of sustained controllable flight. Finally, in 1914, Dr. Charles D. Wolcott, who had succeeded Professor Langley, after the latter's death in 1906, as secretary of the Smithsonian, asked my advice about getting Glenn H. Curtiss to take the machine to his experimental station at Hammondsport, N. Y., and there make some tests of it with pontoons attached so it could be operated as a hydroaeroplane. I enthusiastically seconded Dr. Wolcott's suggestion, and accordingly Mr. Curtiss arranged to make the tests.

Successful Flights

I was unable to give any time to the matter, so that when the first tests were made by Mr. Curtiss, the original engine, which was used as the motive power, was not functioning at its best; consequently the flights made were not long as would have otherwise been possible. The pontoons had increased the weight to about 50 per cent more than the machine weighed in the 1903 tests and this called for twice the engine power. In order to obviate the difficulties that he was having with the long shafts, bevel gears and home-made ball bearings, used in driving the propellers, Mr. Curtiss removed the original engine and substituted an eight-cylinder 80-h.p. one of his own. This was placed in the nose of the machine, with its propeller carried directly by the engine-shaft. The change in balance was corrected by moving the pilot's seat to the rear. Mr. Curtiss flew it personally, and then let others fly it over the waters of Lake Keuka.

With the more recent history of aviation most of us are more or less familiar. In 1908 great popular enthusiasm was aroused by the public flights in Europe by the late Wilbur Wright and in this country by Orville Wright. The early work of Curtiss was followed by his invention and improvement of the flying boat. We are still better acquainted with the wonderful work which is being done in the great European war with the flying machine.

Last summer I spent several months in England. It was the first trip I had made since the memorable one in 1900, when in our quest for an engine for the flying machine we had been advised that the lightweight engine we sought was not only impossible, but that the object for which we wanted it—a flying machine without a gas bag—was impossible. On this trip I was there to investigate the actual performance of the several hundred machines supplied to Great Britain by the Curtiss Company.

The Congressman who in 1903 denounced Professor Langley on the floor of Congress for squandering the people's money on such a fool contrivance as a flying machine was not the true prophet that a hostile press at that time lauded him as being.

While the early history of aviation covers a period of time as great as that of the development of any other means of power-actuated transportation, and the period during which it has now been practised is shorter than that of any other such means, still the rate of progress that it has made in this latter period is perhaps greater than that made by any of the others during a similar period of years. The commercial application of aviation will doubtless be developed more slowly than that of any other means of transportation, still its importance in war operations is undoubtedly greater than that of any of the others, except of steam locomotion.

Developments in the Future

Aviation is a subject peculiarly interesting to the engineer. Owing to the absolute necessity for the combination of maximum strength and minimum weight, the broad fundamental principles of mechanics must be kept clearly in view in designing the machines and their component parts. They must be rigidly analyzed as structures by well-known methods of statics and as machines by methods of dynamics, utilizing in the latter the comprehensive methods developed in the last few years in Europe, where some of the most capable mathematical analysts and physicists have been carrying on such investigations.

At present we are trailing as regards high speed land machines. How can we overcome this handicap and become the leaders in this line? It is, I think, largely a question of money. It costs to experiment in aviation, especially to develop machines in which refinement to the last detail is the keynote. The designer must be able to call for parts as he wants them, regardless of the expense involved. Also it is expensive, so far as initial outlay is concerned, to rush construction work. In this work, however, it has to be done—and especially so in war time. War itself is expensive, but it is especially so if equipment is not equal to or better than that of the enemy. If the war lasts two years more, and I expect it to last at least that long, we will be producing machines in this country that will have as high speed and rapid climbing qualities as any in the world.

I believe that in the early future some important developments of flying boats will take place. I think they will prove to be the answer to the submarine: a flying boat large enough to carry a gun of sufficient caliber to sink a submarine by firing at it when the latter is submerged with nothing but its periscope showing. Such a flying boat might also easily be equipped with torpedoes and with tubes for launching them, so that it could fight the submarine with its own weapons, or could be used against commerce raiders. Certain it is, I think, that the largest flying machines will be made of the marine type and machines several times the size of any so far made will be seen in a very few years.

The most important advances that are to be expected in the next two years are, I think, in the improvement of aviation engines. We have some good engines now, but I believe the engines of two years hence will be immensely superior to those we now have, especially in the matter of weight per horsepower and in dependability. The thing requiring the greatest development in order properly to increase the dependability of the engines is ignition. This includes the magneto, the circuit breaker and the spark-plug. The one thing most greatly needed just now is a spark-plug that is durable and dependable when used in an engine with a high mean effective pressure. The more important points of the spark-plug that require great improvement are air tightness, electric insulating qualities, resistance to the intense heat combined with the requisite mechanical strength, and freedom from causing pre-ignition troubles when so mounted in the cylinder as to insure the most dependable and rapid ignition of the whole charge.

Aeronautic Standardization

The standardization work of the S. A. E. has been one of the greatest factors in the development of the automobile industry. We propose to do the same thing in aeronautics. Why should each manufacturer have sufficient differences from other manufacturers in the length of turnbuckles, so that they are not interchangeable? Similarly as regards shackles, rod-end pins, bolt heads and nuts, wire sizes and strengths. Why should the width of engine-bed supports be so different for each make of engine that it is impossible to complete the design of the body of the machine without knowing definitely the exact engine that will be used? Suppose the factory where the engines are being built is destroyed. Should the manufacture of machines be wholly upset until the engine factory is rebuilt, or should the design of the nose of the machine have to be changed to receive another make of engine of about the same power? Such a change as even 1 in. in the width of engine beds is likely to completely upset production for two weeks or more.

Standardization work in order to be effective must have the co-operation of the manufacturer. The manufacturer naturally does not want to change any detail during production. Therefore, the aim is to get standards laid down that appeal to the designing engineers as reasonably suitable, so they will adopt them in all new work, and to get the manufacturing executives to insist that their designing engineers shall use such standards, as far as possible, in order to decrease the difficulties and cost of securing parts or accessories by giving the greatest latitude possible to the purchasing department to select the vendors.

(*Continued from page* 781)

Two of the accompanying illustrations show the machine used to test the wheel at the Bureau of Standards, and the appearance of the wheel at the conclusion of the test. The formal report by the Bureau was accompanied by graphic charts, the curves upon which were plotted from the results obtained, showing the elastic action of the wheel under load. As the chart lines are indistinct, they are incapable of being reproduced here. The report follows:

Department of Commerce,
Bureau of Standards,
Report on Ackerman Wheel Submitted by Signals Corps, War Department.
Furnished by Ackerman Wheel Co.,

1. The following two tests were made:
   (a) To determine maximum component parallel to the axis.
   (b) To determine maximum component perpendicular to the axis, and hysteresis, if any.

2. Test (a) was performed by holding the hub rigidly and applying the load at the edge of the rim. Plate I.

Test (b) was performed by holding the hub rigidly and applying the load at the top of the rim. Plate II.

3. Results:
   (a) Ultimate strength—3,800 pounds.
   (b) Ultimate strength—8,950 pounds.
   Permanent deflection of rim=4.22 in.

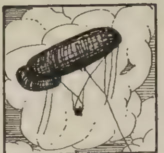
4. Location of failure:
   (a) Two bolts (×) (see plate I) broke at root of threads. This allowed spokes to slip out which in turn broke nickel-plated hub plate.
   (b) Two spokes broke by bending. (See points (×) plate II.) Rim and spokes permanently distorted as shown on plate II.

5. Test procedure:

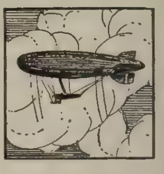
In each test the load was released after an increase of 500 pounds over that of the previous load. In test (a) measurements were made between punch marks on rim and foundation channel. One set of marks was immediately under the point of application of the load and another was 180° from this point. Measurements for test (b) were made from the rim to a point on the hub directly under the load and 180° from same.

The curves are plotted from the results obtained and show the elastic action of the wheel under load.

(Signed) S. W. STRATTON,
Director.



MILITARY AEROSTATICS



St. Louis Balloon School Active

Lieut. A. B. Lambert, S.O.R.C., the enterprising president of the Missouri Aeronautical Society and member of the Board of Governors, Aero Club of America, has been doing some energetic work to assist the War Department in getting and training reserve balloon pilots.

As soon as President Wilson declared a state of war to exist and the official approval was given to the developing of our air forces on a large scale, Mr. Lambert promptly established a large training school for training students for the Signal Officers' Reserve Corps.

The Missouri Aeronautical Society has been operating a balloon school in St. Louis since May 15th. This school was organized to cooperate with the War Department in the development and training of balloon pilots; a very important, but neglected branch of the service.

So important was this work considered, that no expense was spared to organize and purchase equipment, and to lease a park of eight acres, including large buildings for barracks, drilling grounds and garages.

The original work of the organization was in the hands of A. B. Lambert, who since then has received a commission as 1st Lieutenant, Aviation Section, Signal Officers' Reserve Corps, and who now has supervision over the school. Mr. J. W. Bemis, a distinguished balloon pilot, is now President of the Missouri Aeronautical Society, and has given his entire time to the operation of the school. The official pilots are E. S. Cole and Paul McCullough, assisted by other St. Louis pilots.

Since May 15th, 2,700,000 cubic feet of gas has been used; 65 ascensions, and 28 students qualified in accordance with the rules of the International Aeronautical Federation.

The school at present has 24 students, all candidates for commissions in the Aviation Section.

The Aero Club of America is giving its full co-operation, and has loaned, for this important work, the America III, of 80,000 feet capacity.

Additional equipment: One 80,000, Uncle Sam; four 40,000, Nos. 40, 41, 42, 43; one 50,000, A. B. Lambert; one 20,000, Jitney; one 14,000, Picnic. Four new balloons on order.

One feature of the training is the early morning flights, just as the sun rises, a demonstration and experience on Expansion, and the late afternoon flights, as the sun goes down, a demonstration and experience on Contraction. Also dummy balloon work and lectures. An average of three to five flights are made daily.

Lieut. Lambert is a licensed pilot for both balloons and aeroplanes.

Airship Nomenclature

Frequently articles in the lay press and even occasionally in technical papers, grate on the nerves more because of the weird jargon in which they are expressed than because of any real shortcomings in the matter contained in them, and to this may be due in part the somewhat disdainful attitude towards non-Service publications adopted by the majority of the members of the Services.

In the case of airships this attitude is possibly more pronounced even than with aeroplanes, as there are few people outside the R. N.A.S. who have really studied airships, and even those few often write in a language different from that in use among Service people and so arouse the possibly unmerited derision of the latter. It has, therefore, been attempted in this article to lay down something in the nature of a standard expression for some of the parts of an airship, following, as far as can be ascertained, the phraseology in use in the Service.

In a non-rigid airship the gas-containing portion is the "envelope"—not the "gas-bag"—and the "ballonnets" are the air-bags inside the envelope for maintaining pressure. These are, of course, quite distinct from the gas-cells of a rigid airship which are known as "gas-bags," the word "ballonnet" being quite wrong in the latter connection.

The part of an airship which contains the crew and power plant is the "car"—not the "nacelle" or any other French phrase—though in the case of a rigid airship the cars are frequently known as "gondolas," following the German practice.

The naval terms "starboard" and "port" are used to represent the right and left respectively of an airship when looking towards the bow. Properly speaking the front of the envelope is the "bow" and the tail the "stern," though the expression "nose" is sometimes used, as in describing the bamboo or built-up wooden girders called "nose-stiffeners," which serve to prevent the nose blowing in at high speeds. Skids and wheels, if fitted, are the "landing carriage," and an alternative in the shape of a fabric bag filled with air is the "bumping bag."

Ropes attached to the envelope by which the handling party holds the ship when on the ground are "the handling guys": "forward," "midships" or "after," according to their position. Similarly the cables on which the car is suspended are called "rigging guys," while the strip of fabric sewn and stuck to the envelope to which they are attached is the "rigging band." The method of attaching the rigging guys to the rigging band is either by "toggles"—small round pieces of wood—or "crow's-feet," which consist of three pieces of fabric doubled over with the loops "seized" with cord; these are arranged in the form of a fan and the ends sewn or stuck to the rigging band, the end of the rigging guy being taken through the three loops.

Lieut. A. B. Lambert, who is doing such excellent work with the St. Louis Balloon School.

A rigging guy after leaving the car branches into two, each of which subsequently divides into two again, and so on till the envelope is reached. This is for the purpose of distributing the weight over as large a surface of the envelope as possible, and each step in the chain is known as a "bridle." Where a guy branches into two to form a bridle, there is usually a "thimble," which is a heart-shaped metal ring with a grooved surface on the outside to take the eye of the cable.

A "grommet" is formed by taking a piece of rope and forming it in the shape of a circle, and then wrapping the ends round the circle until the whole piece of cord has been put into the ring. It is used to protect the edges of any circular hole from tearing.

The "trail-rope" of an airship is a rope about 150 feet long, which is dropped by the pilot into the hands of the landing party when coming down to land. The strain of the ground party hauling the ship down is taken at the "mooring point" where the trail-rope terminates in an eye, from which the strain is distributed by ropes running to different points on the car or envelope. The grapnel is a small anchor usually on a short piece of rope, free to slide when released down the trail-rope until it reaches a knot provided for the purpose.

In a rigid airship the "hull" is the whole of the gas-containing portion as distinct from the cars. It comprises the "outer cover," and the "gas-bags" between which is a space sometimes called the "ring space." The hull in Zeppelin-type construction is built up of longtitudinal girders running the whole length of the ship, which are either main or intermediate according to their strength, and are lettered on drawings commencing with the "A" girder at the top.

There are also "transverse girders" running round the ship which are similarly divided into "main" and "intermediate." The main transverse girders come between the gas-bags and are braced to a ring at the centre by "radial wires." The main transverse girders or "main frames" are numbered, commencing with "No. 1" at the bow.

In most rigid airships the hull has not the requisite structural strength to be self-supporting and a "keel" is therefore necessary. This is formed of tubes or girders, and may be either external—*i.e.*, fitted below the three bottom main longitudinals—in which case it is V-shaped, or internal when it is usually A-shaped, having a cross-bracing member, forming the cross-bar to the "A," about half-way up. At the bottom of the internal keel, or on top of the external, as the case may be, is the gangway giving access to any of the cars and also for examination of the gas-bags during flight. Access to a gun-platform or observation platform on the top surface is gained by means of a "climbing tube" between two of the gas-bags.

An airship's stabilizing surfaces are called "planes," whether horizontal or vertical, while the moving surfaces are "elevators" and "rudders" as in aeroplanes.

An airship is never spoken of as a dirigible, nor is the pilot referred to as an "airman"; while the term "Blimp" for an S.S. airship is never used in the Service, but only by those outside who wish to give an impression of being in the close touch with Service matters.

The crews of airships are divided according to their duties roughly into five categories—pilots, coxswains, engineers, wireless operators, and crews—of whom the first only are officers. Of course, in a small ship the various duties are carried out by whatever personnel is available, so that the pilot may be his own coxswain and engineer; while in big ships it may be necessary to carry two pilots and several engineers and coxswains.

In conclusion in may be remarked that it is almost as grave an offence to speak of the "front nacelle" of an airship—instead of the "forward car"—as it is to call a waistcoat a "vest," unless, of course, one is in the tailoring line.

Army Balloon Makes Forced Landing

Terre Haute, Ind., Monday.—A United States Army balloon, carrying eight officers and men from St. Louis, landed on a farm five miles south of this city early to-day. Reports from the farm said the men with the balloon stated they were compelled to land because of rents in the bag. The bag was set afire and destroyed after landing. The remainder of the equipment was placed in a farm wagon and started for this city.

Balloon Officers Pay.

The Department Aeronautical Officer, Northeastern Department, announces that in addition to the $2,000 base pay to graduates as Balloon Pilots under the Commission as First Lieutenants, the men will receive during their training at the Observation Balloon Schools, a compensation at such rate that their total pay will be $100 per month, and 75 cents a day allowance for rations.

FOREIGN NEWS

FRANCE

Paris, July 31.—Sergeant Thomas M. Hewitt, of New York, barely escaped serious injury in misjudging his landing place after an aerial reconnaissance, according to word from hearquarters of the Lafayette Escadrille to-day. He crashed to the ground and was stunned.

Aug. 2.—Acting as a gunner in a British aeroplane, Sergt. J. A. Drexel, of the Lafayette Escadrille, dropped a ton of explosives over the German depot of Bruges, according to announcement today. He returned safely despite fierce cannonading and a sky illuminated with German searchlights, rockets and flares.

Recent dispatches indicated Drexel had been temporarily detached from the Lafayette Escadrille for special service. The above indicates his new detail is with the British flying corps.

Drexel is a resident of Philadelphia and learned to fly under Bleriot in 1909, being for a long time holder of duration and altitude records in the early days of aviation. He is twenty-five years old.

Sergeant Harold Willis of Boston has been proposed for the decoration of the cross of the Order of Leopold, a rarely bestowed Belgian war medal, as a reward for efficient work with the Lafayette Squadron.

Lieutenant Raoul Lufberry on July 30 destroyed a two-seater German aeroplane which fell too far behind the German lines to be traced to the official credit of the American "ace" airman.

Complete allied mastery of the air has been achieved on that section of the front where the Lafayette Escadrille is located. Dispatches from the squadron's headquarters declared the star fliers of the Lafayette Corps, including Capt. Thenault, Lieut. Thaw, Lieut. Lufberry and Sergts. Rockwell, Parsons and Willis had flown a distance of twenty miles behind the German lines without ever sighting an enemy plane. Most of their reconnaissance was over German aviation fields, but the enemy declined to fight.

The destruction of a large German submarine by bombs hurled from a French aeroplane was described on August 2d by passengers on a liner which arrived at an Atlantic seaport from Europe. The 'plane, they said, was one of a pair which convoyed their vessel for three days, in company with a number of torpedo boat destroyers and a "mother ship," to which the aircraft retired from time to time for fuel and supplies.

The engagement between the U-boat and the aeroplane took place when the liner was two days out from a European port. Braving the destroyers and the battle planes, the big German submersible fired a torpedo at the liner, missing her stern by a scant forty or fifty yards.

Scarcely had the Whitehead been launched from the submarine's tube than the passengers saw one of the two aeroplanes, which had been hovering above, dart from an altitude of approximaely 1,000 feet to about fifty feet above the water. It was perhaps half a mile from the liner.

Apparently arriving at a point directly above the U-boat, the passengers saw the occupant of the aeroplane drop six bombs in quick succession. The sixth bomb evidently struck its mark, for immediately after it fell there was a tremendous explosion and a huge geyser of water was thrown into the air.

The aeroplane thereupon returned to the mother ship, which was steaming along in the rear of the liner, and was taken aboard.

Paris, Aug. 1.—Captain George Guynemer, one of France's leading airmen, has brought down his fiftieth German aeroplane.

The French aviator had been sick in the hospital the latter part of July, but July 28 he returned to duty and on the same day brought down one machine north of Ypres, Belgium, and another, the fiftieth, close to Southulst Forest.

Paris, Aug. 3.—Colonel William S. Mitchell, head of the American Aeronautic Mission to France, was officially received Thursday night at the Aero Club of France. Speeches were made by Henri Deutsch de la Meurthe, president of the club; Daniel Vincent, Under Secretary of Aviaion, and Senator Gaston Menier.

Colonel Mitchell warmly thanked the speakers in the name of American aviation and spoke of the perfect collaboration which he had found in official, military and private aviation circles. After the speeches Mr. Deutsch de la Meurthe handed a silver plaquette to Colonel Mitchell.

GERMANY

Numerous instances are related of pilots charging anti-aircraft gunners and machine gun operators at a height of thirty or forty feet and silencing the guns. Pistol duels between British aviators and the German infantry are not uncommon occurrences.

In one instance a young aviator, in a burst of chivalry, deliberately stopped his machine gun. When a German officer drew his pistol and began shooting at him he engaged the enemy with his pistol, apparently feeling that he had no right to take an unfair advantage of his opponent.

GREAT BRITAIN

Since the beginning of hostilities 366 persons have been killed and 1,092 injured by air raids in the London metropolitan area, according o a statement made by Sir George Cave, the Home Secretary, in the House of Commons.

During the same period, the Secretary noted, 2,412 persons were killed and 7,863 injured in ordinary street accidents in the same territory.

An official report of conditions on the Balkan front, dated July 27, says: British aviators have bombed enemy camps in the region of Demir-Hissar.

British Headquarters in France: Bombs were dropped by British aeroplanes on a German airdrome, two important railway stations and an ammunition depot, where fires and explosions were caused on July 28. Bombing operations continued on the 29th, and there was great activity in the air until 10 o'clock in the morning, when a severe and sudden thunderstorm prevented further flying. Many of the British aeroplanes were caught in the storm and four have not returned.

In the air fighting four German aeroplanes were brought down and two others were driven down out of control. Six British are missing, including those lost in the storm.

According to an official statement from the London Times to the New York Sun on August 2, 420 aeroplanes were lost on the western front in July. The Times admits that these figures are inexact, owing to variations in the French and German methods of announcing air losses. The month's losses are the third highest of the war and compare with 392 for June, 713 for May and 717 for April.

The July losses are divided among the belligerents as follows: German machines, 291; Allies, 129, of which 89 were British, although this figure probably is incomplete. The British bagged 247 German machines, the French 35 and the Belgians 9.

HOLLAND

Amsterdam, Aug. 5.—A German aeroplane landed on the island of Ameland on account of motor trouble. The occupants of the machine were interned.

Ameland lies in the North Sea off the coast of Friesland. It belongs to the Netherlands.

ITALY

Rome.—Large squadrons of Italian aeroplanes on August 2 effectively bombed the arsenal and military works of Pola, the chief naval station of Austria-Hungary on the Adriatic. The Italian War Department says:

"Above Tolmino one of our airmen brought down an enemy machine in flames and forced another to land within its own lines.

"Last night our large flights effectively bombed the arsenal and military works at Pola. All the machines returned safely to their bases. Enemy machines also carried out a bombing raid on some inhabited localities on the lower Isonzo."

Rome, Aug. 5.—Numerous aircraft activities, in one of which a hostile seaplane was brought down by the Italian guns, falling into the River Po, are reported in the War Office statement. The text reads:

"Along the whole front desultory artillery activity and minor patrol encounters are reported.

"During the night of August 4 enemy aircraft carried out bombing raids on various inhabited centres on the plain between the Isonzo and Tagliamento. There were no casualties and only slight damage was done.

"An enemy seaplane was brought down by our anti-aircraft guns and fell into the River Po, near Ponte Lagoscuro. The airmen were made prisoners."

A dispatch to the New York Times on August 5 tells of the Italians launching against the Austrian naval port of Pola vast and startling flights of giant Caproni aeroplanes, each with a crew of four or five men, and as if to place upon the enterprise the final cachet of Italian perfection, with each raid there travels in the leading machine the single man whose words and gestures are followed breathlessly throughout the country, Gabriele d'Annunzio, the acclaimed poet of the Italians. The Austrians, too, have been raiding lately, sprinkling bombs on many inland villages far from military objectives.

The Italian raids upon Pola during the nights of August 2 and 3 were not merely reprisals for many useless murders, but an assault upon the nest of submarines, airships, aeroplanes, and war vessels with which Austria seals the entry to the Gulf of Trieste. The results, which are yet to be confirmed and tabulated, are surely great. I have heard the statement of an aviator who took part that Pola as a naval base is already extensively damaged.

The first raid was carried out by thirty-six machines, including fast fighting machines, which escorted the great Caproni bomb droppers. It was like watching a flotilla of destroyers go to sea as the great machines moved off at four-minute intervals, taking up a perfect alignment against the sky. Motorboats were out to guide them to the Austrian coast, for there was a fog over the sea. Before midnight the squadron was over Pola, maneuvering amid a tangle of searchlight beams and a hurricane of shots from panic-stricken gunners in the city's defenses. Bombs ranging from 70 to 200 pounds were raining down on the arsenal, dockyard and anchored ships.

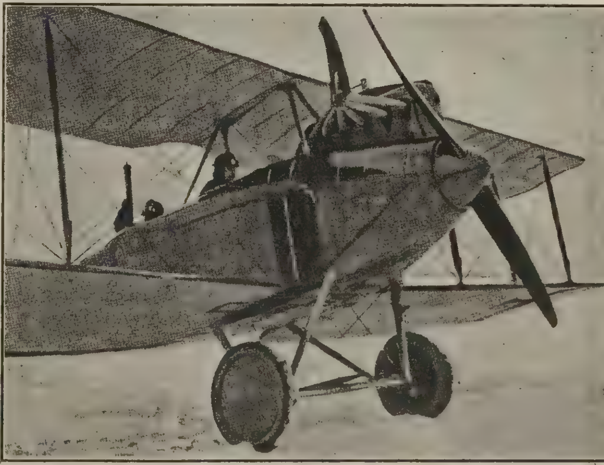
Three waves of aeroplanes went over, and the first two saw a huge explosion in the arsenal and a great fire start up, either in the arsenal or in the submarine depot. Six and a half tons of bombs were dropped in all, and there would have been more but that the third wave of attackers failed to find purely military targets.

The following night they again returned to the attack. This time a light fog favored the aviators and eight tons of explosives were deposited where they were likely to do the most damage. The results were well observed and are described as entirely satisfactory.

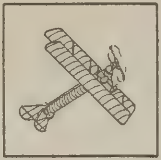
RUSSIA

Baltic Sea—A number of enemy machines on July 30 appeared seven times at various points along the coast and the islands in the Gulf of Riga. At Mentoi and Arensburg they dropped twenty bombs without results. An enemy Zeppelin flew over Zerel.

A squadron of Russian aeroplanes, consisting of 24 machines, flew over St. Vogany on the Lida-Molodechub Railway. Over sixty bombs were dropped.

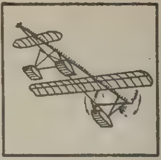


A German D. F. W. Battleplane, one of the latest Aviatik types.



MODEL NEWS

Edited by G. A. Cavanagh



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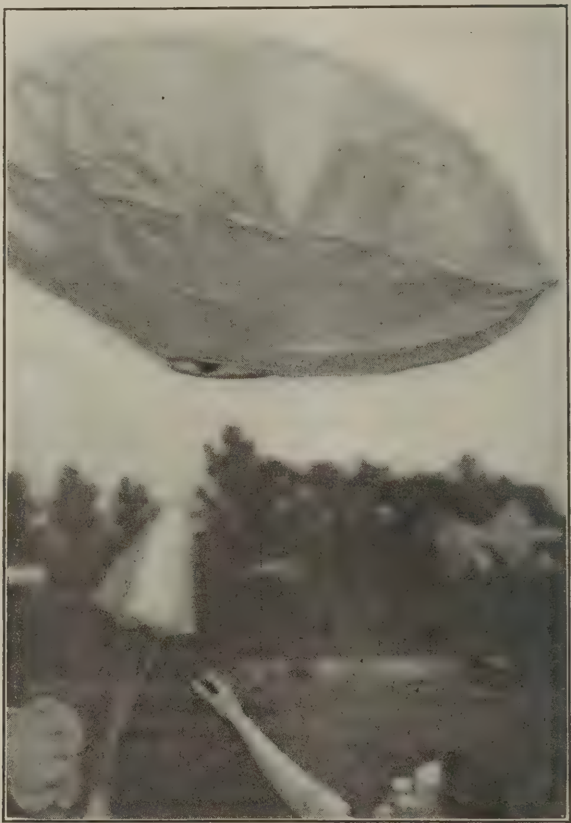
A Model Dirigible

Unusual as it may seem the model dirigible shown in the accompanying photographs not only flies well but performs the remarkable feat of dropping a parachute when it is well into the air. For quite some time model flyers have tried to invent some means whereby a parachute could be dropped from their models while the model was in flight but success was attained in very few instances. Some model flyers also made attempts to build model dirigibles that would fly but up to the present time the one shown herewith, built by the Aero Company, of Binghamton, New York, is to our knowledge, the only one that really proved successful and not alone from the standpoint of flight but also through its ability to drop a parachute while in flight.

On many occasions this dirigible has been made to fly a distance of a mile at an approximate height of 1,000 feet. An interesting feature of this machine is the fact that a light cord may be attached to it thus making it possible to retrieve the dirigible with very little effort. In view of the marked success which the dirigible has already attained the sales are not confined to purchasers in the United States but extend to people in the Hawaiian Islands, Alaska and other foreign countries who are interested in this new and interesting advent in the field of model aeronautics.

There is little doubt but that those who purchase this dirigible will find it not only a source of much pleasure but also valuable from a scientific standpoint.

Inflating and preparing the dirigible for flight



The dirigible rising. The parachute may be seen having been prepared to drop at a predetermined moment

Flying Kites to Study Weather

(*Concluded from page* 684)

The loose end of the wire had caught on a fence near Florence, Neb., a suburb of Omaha, twenty miles away, while the kites remained in the air. The kites were then pulling about 250 pounds on the wire and it was 3 A. M. the next day when they had been landed and taken back to the station.

Static electricity gathering in the kite wire presents one hazard in the work. A voltmeter in the reel house registers as high as 50,000 volts and on several occasions its capacity has been exceeded. The reel itself, mounted on insulators, is connected with the ground by large wires to carry off the electricity that is drawn down the kite wire. By opening a switch that connects these large wires with the ground, the electricity is sent through the voltmeter instead. Naturally while the current is being measured, the reel itself becomes highly charged and great care has to be taken not to touch it inadvertently. When the reel is thus disconnected in the evening, it often glows with the pale blue discharge.

Each evening the results of the day's observations are telegraphed to Washington and Chicago for assistance in making up the weather forecasts for the next day. At longer intervals the tabulated results are forwarded to Dr. William R. Blair of Washington, who is in charge of all the aerological work for more detailed study. During the year ending December 1st, 1916, 528 flights had been made in Nebraska. Flights were made on every day except twenty and twice a month the thirty-six hour periods of nine flights each were observed. The average altitude reached by the kites was one and a half miles and the highest about three and a half miles.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

The Ultimate Missile

A seaplane was his and a seaplane was mine,
We started the scrap at a quarter-past nine;
To settle the issue beyond any doubt,
We came down on the water to fight it out.
I fired my gun till the trays were shot,
Then I fired five rounds from a Webley Scott.
I chucked my trays and I chucked my gun.
I heaved my instruments one by one;
They all of them missed and he started to scoot,
Till I laid him out with a well-aimed boot.

A tired aviator, burdened with about five tons of equipment, climbed wearily into a bus outside a London railway terminus. There were no vacant seats and no one offered the weary man a seat. He was dead tired and so resolved to get a seat by strategy. He flashed from his haversack a small bomb.

"This is one of the things we use out there, you know," he remarked to the interested passengers. "See this pin here? When I pull it out like this it should explode fifteen seconds later. They're pretty deadly, too. If I put it back again the thing's harmless." Then, beginning to search frantically, "Gosh! Where on earth did I put that pin?"

The passengers rose in a body and scrambled for the door, tumbling over one another to get off. Tommy watched them go. Then, putting the bomb back in his haversack, he stretched himself full length on the cushioned seat.—*Pittsburgh Chronicle-Telegraph.*

Before introducing Lieutenant de Tessan, aid to General Joffre, and Colonel Fabry, the "Blue Devil of France," Chairman Spencer, of the St. Louis entertainment committee, at the M. A. A. breakfast told this anecdote.

"In Washington, Lieutenant de Tessan was approached by a pretty American girl, who said:

"'And did you kill a German soldier?'

"'Yes,' he replied.

"'With what hand did you do it?' she inquired.

"'With this right hand,' he said.

And then the pretty American girl seized his right hand and kissed it. Colonel Fabry stood near by. He strolled over and said to Lieutenant de Tessan:

"'Heavens, man, why didn't you tell her that you bit him to death.'"—*Kansas City Star.*

The Philadelphia *Bulletin* probably maligns Secretary Baker in ascribing to him, even in jest, the idea that the Army is governed by by-laws. But here is the *Bulletin* story, amusing at least:

"The neat and even elegant appearance of the American soldier isn't maintained," said War Secretary Baker, in a Washington address, "without hard work. Yes, the work is hard, but doesn't the result more than justify it?

"On the train the other day a private sat with his tunic unbuttoned, for the temperature was high. A sergeant strode up to him and said:

"'Button up that tunic! Did you never hear the by-law 217, sub-section D? I'm Sergt. Jabez Winterbottom.'

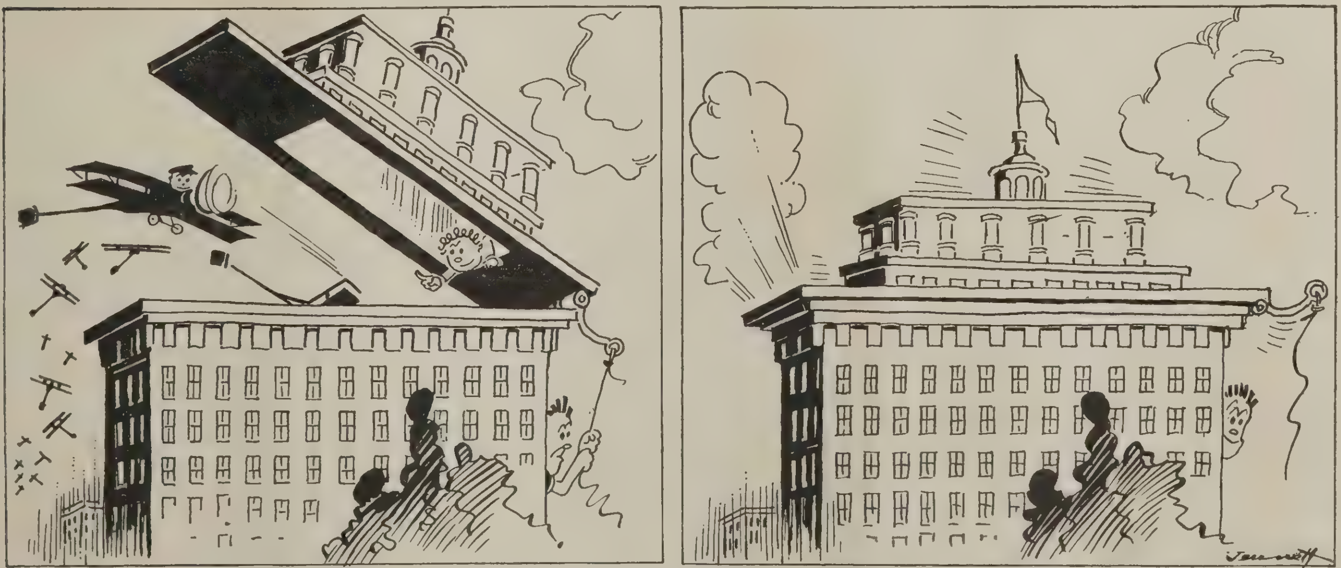
"A gentleman in the seat behind tapped the sergeant sternly on the shoulder.

"'How dare you issue orders,' he said, 'with a pipe in your mouth? Go home and read Par 174, Sec. M, Part IX. I am Major Eustace Carroll.'

"Here a gentleman with a drooping white moustache interposed from the other side of the aisle.

"'If Major Carroll,' he said coldly, 'will consult by-law 31, Sec. K. he will learn that to reprimand a sergeant in the presence of a private is an offense not lightly to be overlooked.'"

Young Flight-Lieut. (home on leave)—Waiter, my neighbor's efforts with his soup (by the way, I'm sure he ought to be interned) are more than I can bear. Would you oblige me by asking the band to put up a barrage?—*Punch.*



If authorities are to consider the possibility of accommodating aeroplanes within city limits when the time comes to commute by aeroplane, we would very much like to have the accompanying suggestion considered. This clever idea was formulated by the celebrated Irish inventor, Pat Pending. In order to demonstrate how easily the plan may be carried out, Pat himself volunteered to perform the deed, as may be seen in the picture. More of Pat's inventions of how aeroplanes may be landed on the tops of buildings will be shown in forthcoming issues.

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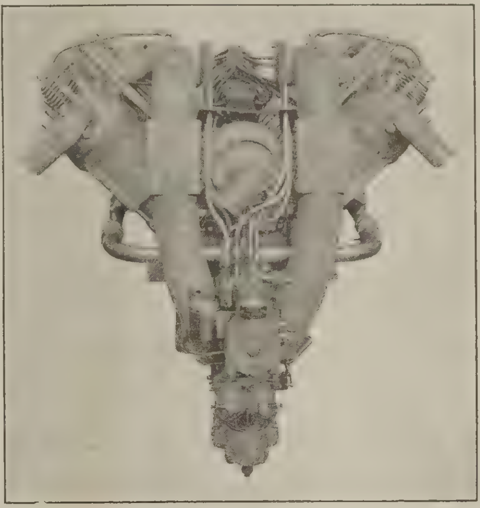

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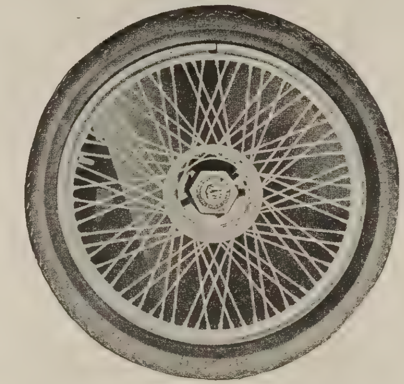

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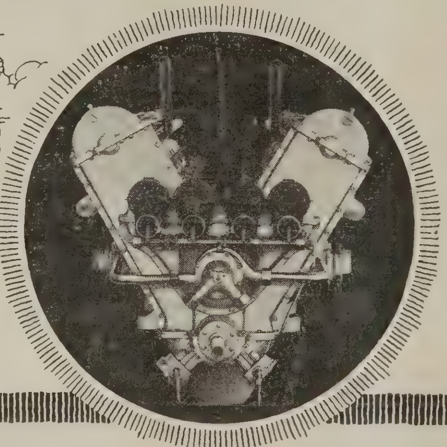

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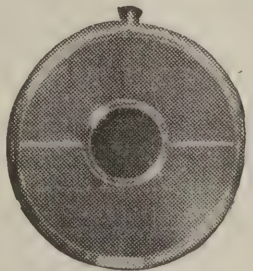

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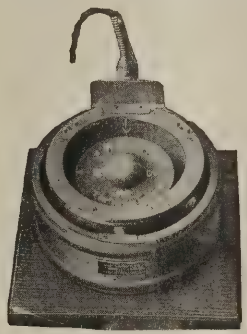

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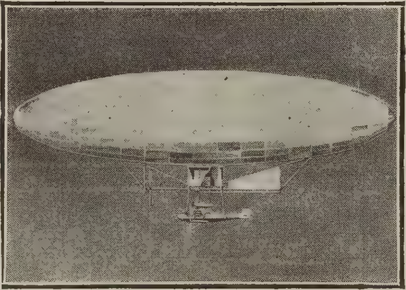

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(Continued from page 768)

more than seven other members of recognized capacity and achievement along industrial lines to be appointed by the President, by and with the advice and consent of the Senate.

The board shall elect one of its civilian members as president thereof, and said board and tenure of office of the members thereof shall continue during the pleasure of the President, but not longer than six months after the present war. The civilian members of the board shall serve without compensation.

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The board is also empowered to employ, either in the District of Columbia or elsewhere, such clerks and other employees as may be necessary to the conduct of its business, including such technical experts and advisers as may be found necessary and to fix the compensation thereof; it may rent suitable offices in the District of Columbia or elsewhere, purchase necessary equipment and supplies, including scientific publications and printing, and may incur necessary administrative and contingent expenses, and for all of the expenses enumerated above there shall be allotted by the Chief Signal Officer of the Army for the fiscal year nineteen hundred and seventeen and nineteen hundred and eighteen the sum of $100,000, or so much thereof as shall be necessary, from any appropriation now existing for or hereinafter made to the Signal Corps of the Army, and such appropriation is hereby made available for the above purpose: Provided, That except upon the joint and concurrent approval of the Secretary of War and the Secretary of the Navy there shall not be established or maintained under the board any office or organization duplicating or replacing, in whole or in part, any office or organization now existing that can be properly established or maintained by appropriations made for or available for the military or naval services.

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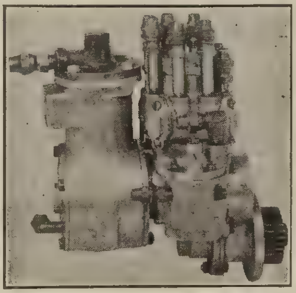

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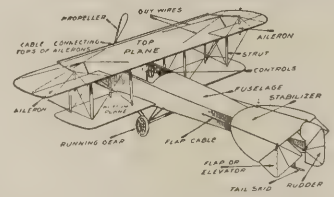

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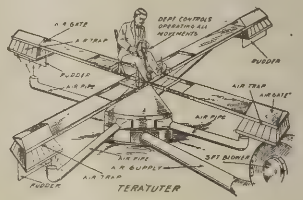

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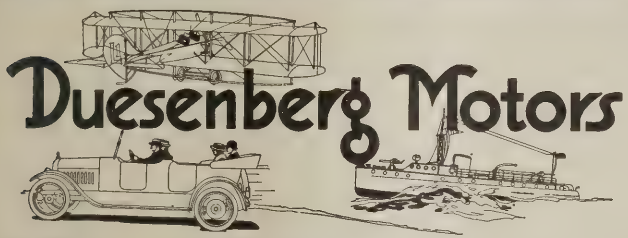

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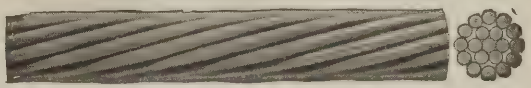

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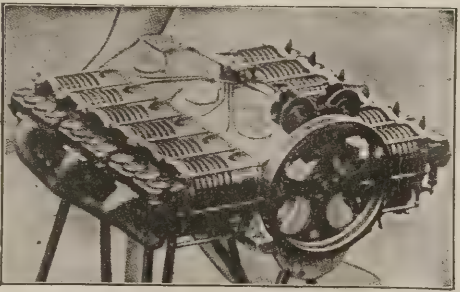

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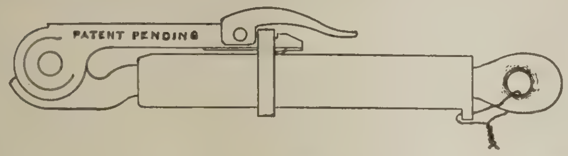

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10% 2 inches by 4 inches.

Price upon application.

The requirements of the American Government's proposed program will exhaust the stock of spruce available at present prices.

Further lumber operations to get spruce out of the forest will be increasingly difficult. In addition, the foreign governments have purchased within the year twenty to thirty million feet. They are now storing this at ports on the Atlantic seaboard, on the Pacific Coast, at Minnesota Transfer, at Montreal, and shipping it into Canada, and are unloading the freight cars at points on the line, and rushing the cars back for more spruce.

The Buck Automatic Aerial Torpedo

AFTER a series of exhaustive tests in Colorado, the Buck Air Craft & Munition Co., who own and control the Buck Automatic Aerial Torpedo Patents, are prepared to negotiate with Governments and other parties for production on a quantity basis.

The Buck Automatic Aerial Torpedo is an air craft equipped with a 50 H.P. Motor, and designed to carry explosives through the air to any distance up to thirty miles. A time controlled release drops the torpedo at any given distance.

The entire equipment is automatic and is launched from a compressed air catapult mounted on a motor truck, the engine of which furnishes the air for the catapult.

The torpedo can be fired at any range and at any degree of the compass.

The launching of the torpedo is without shock, and consequently the most dynamically explosive materials can be carried.

All-Metal Aeroplanes

This company is developing a series of all-metal aeroplanes which can be manufactured lighter than the ordinary aeroplane and at the same time insuring greater durability. Patents are applied for on a special wing construction which is designed to eliminate all tendency to side-slip when the machine is in the air.

The Buck Gravity Stabilizer will be used on all machines manufactured by the company.

The Buck Aircraft & Munition Co., Inc.
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LEWIS & VOUGHT CORPORATION
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The Davenport Aviation School has turned its present factory into an aviation school proper and is giving, in addition to the regular course in flying, actual mechanical instructions without further charge, teaching the student the up-to-date method of aeroplane construction. The student works in the school factory same as an employed mechanic such time as not employed in the field receiving flying training in the air.

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We guarantee our students a position after completing their training course, in our new factory, which will be incorporated separate from the school. The object of this new factory is to build military training tractors in large quantities to meet the present demand for school machines to assist our country in supplying aviators and mechanics for the front.

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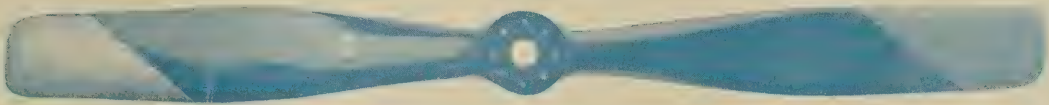

Each propeller designed expressly for the machine and engine on which it is to be used and conditions studied under which it will have to be used.

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Propellers bearing the name Lang are fitted to all the highest speed and best known war machines now in use on the various battle fronts.

Mr. Lang, the originator of the Lang Propeller, Ltd., of England, is admitted to be one of the pioneers of aviation.

Under the heading "Pioneers of British Aviation," The Aeroplane (London), said: "A. Dashwood Lang—the first person in England to devote himself seriously and solely to propeller experiments on scientific and practical principles, has developed a great manufacturing concern from his early wood working efforts."

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The same thoroughness in working to close limits and accurate standards characterizes all Curtiss work, whether in aeroplane or motor constructio

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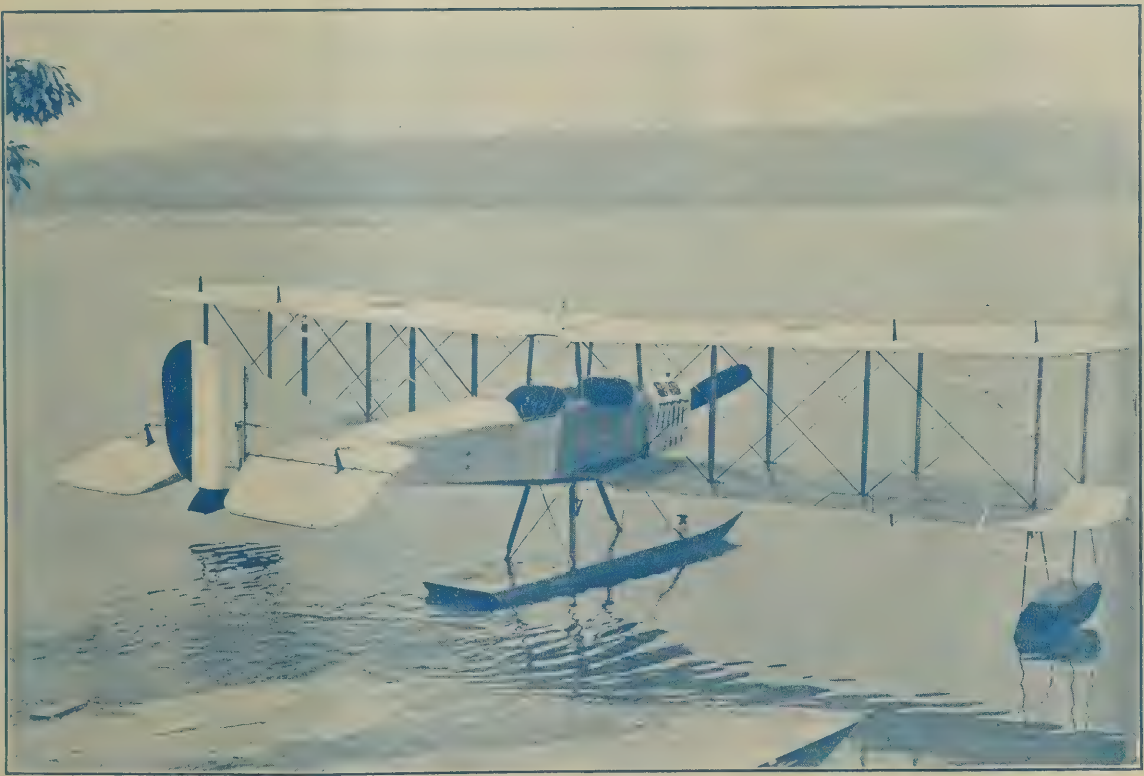

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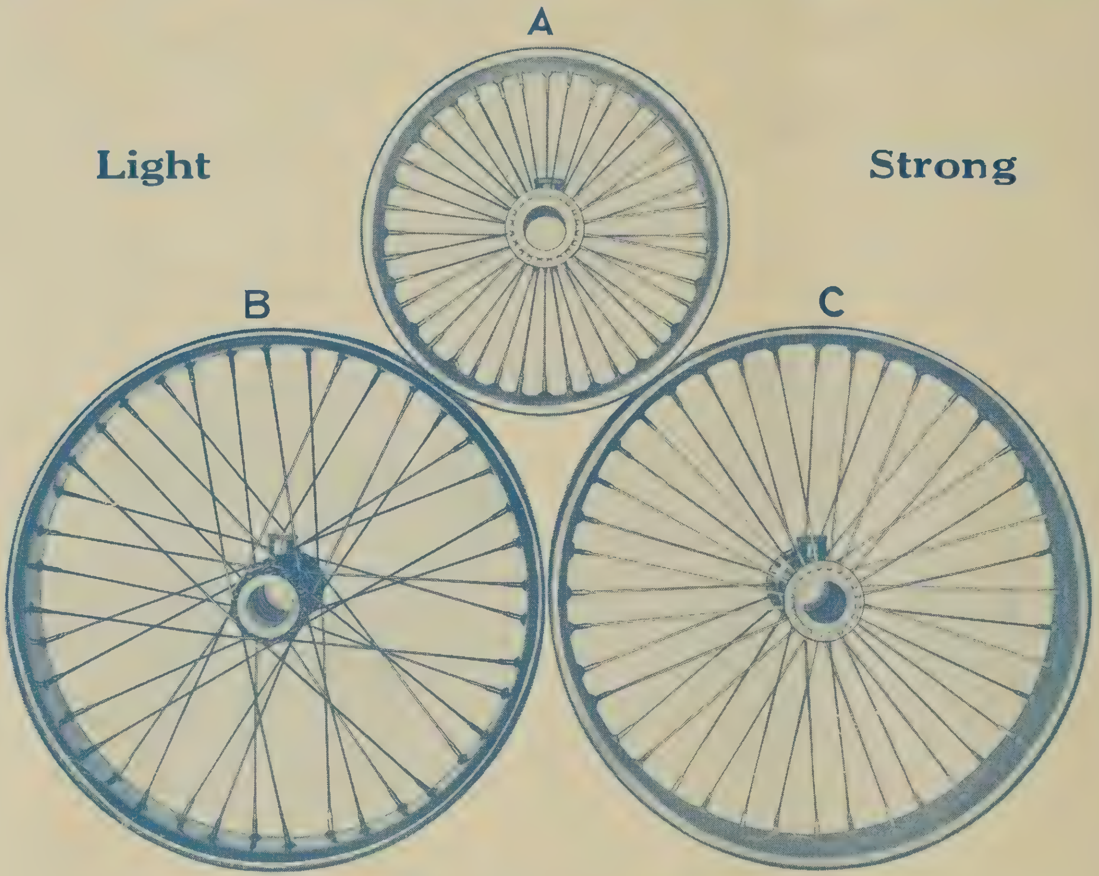
Valuable Decisions Reached by International Aircraft Standardization Committee

HOUK AEROPLANE WIRE WHEELS

For The Finest Planes That Fly



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Rims of all sizes to government specifications
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The factories of this company have been among the foremost in the field of motor-driven vehicles since the earliest days of the industry. Our engineering department and our laboratories are among the most complete in the world.

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Famous for Stanweld Rims, Tubing etc., Perfection Springs, Bock Bearings,
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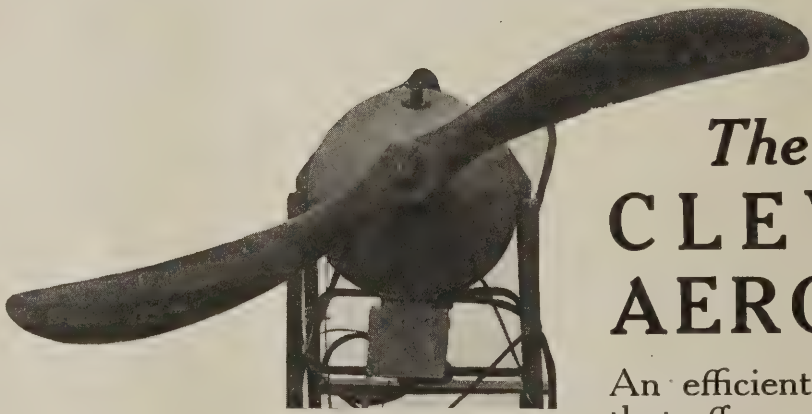

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An efficient Aircraft Power Plant that offers many distinct advantages to the aeroplane constructor.

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ARE
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Constructors can greatly simplify the complex problems of landing gear design by the adoption of rigid axles with ACKERMAN WHEELS and at the same time insure a better landing support for the airplane.

The spring action of the wheel absorbs all shock before it reaches the axle, prevents rebound and makes

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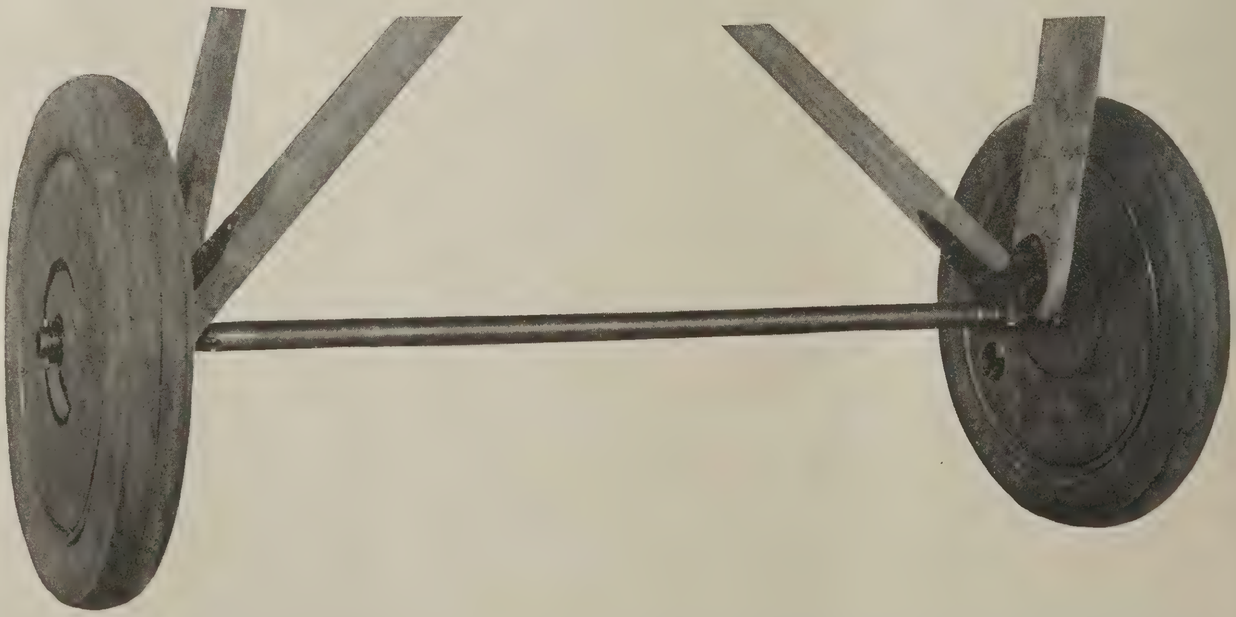

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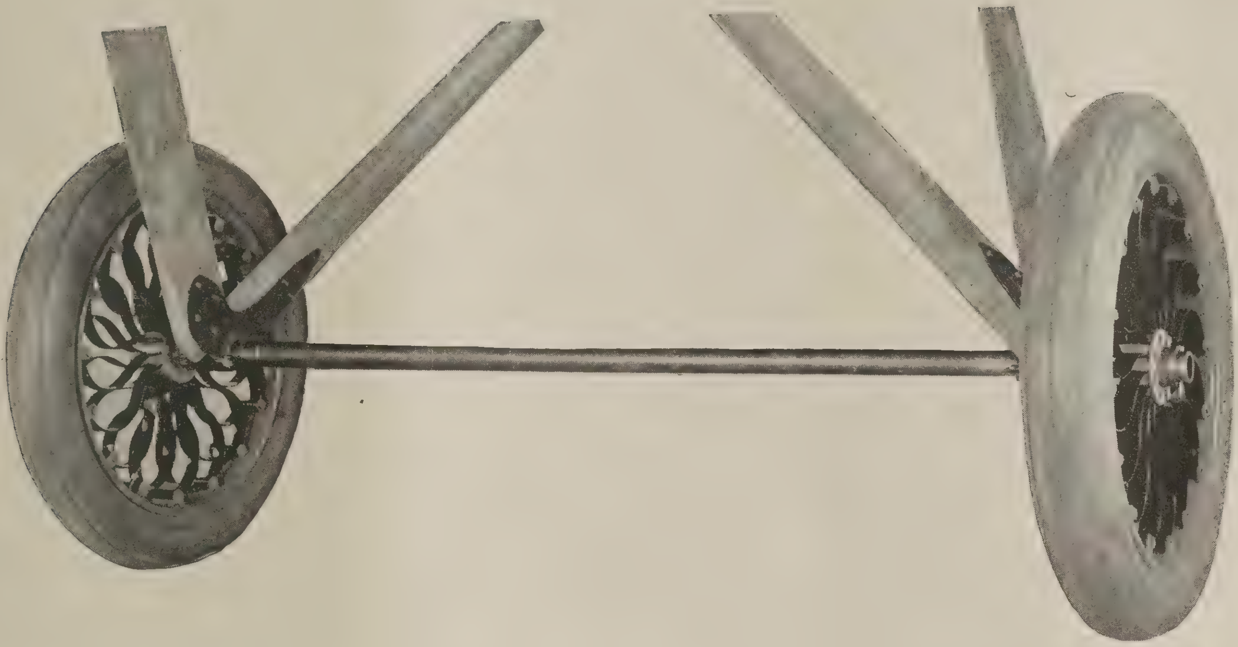

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Wheels built for any weight
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The ACKERMAN WHEEL COMPANY
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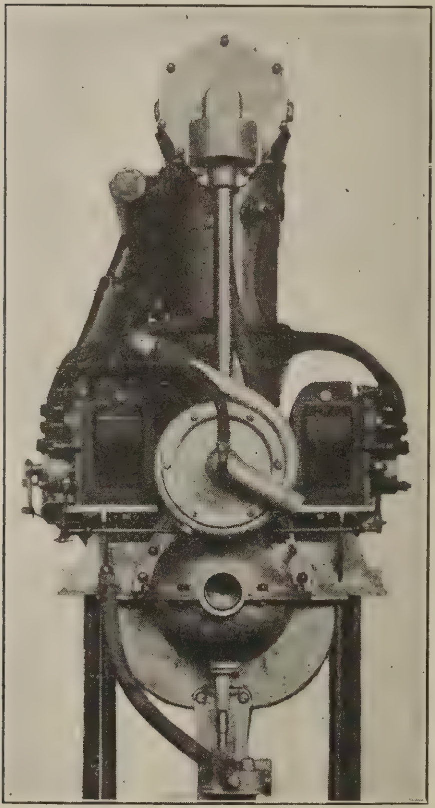

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"The engine performed a very satisfactory endurance test. Observations throughout the test showed that the vibrations were low, quick acceleration and good carburetion maintained, also the absence of oil leakage was another good feature as well as no evidence of water leakage at any of the joints."

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"The inspection of the engine after the 48-hour endurance test showed the fundamental design to be such that satisfactory service would be given by this power plant. The quality of the workmanship throughout was of a very high order, and also that the very best of material had been used throughout the engine."

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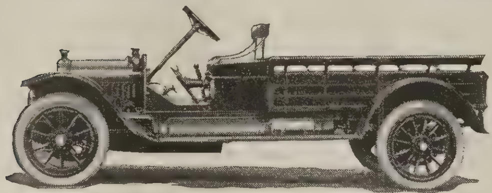

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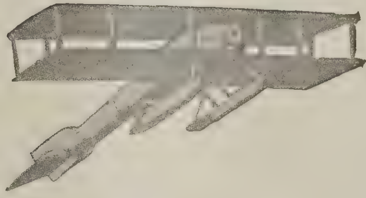

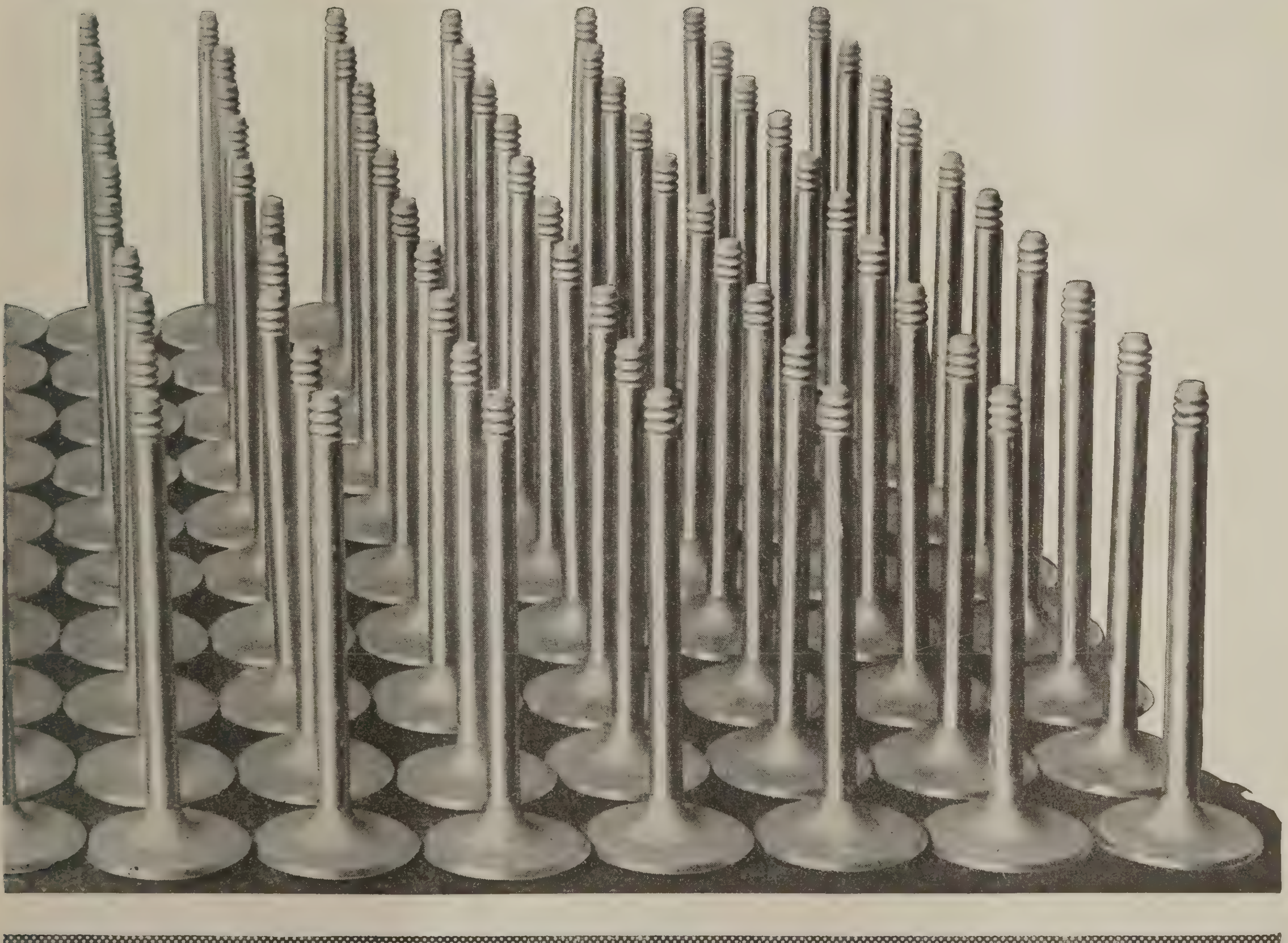

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THE CURTISS AEROPLANE CO., Buffalo, N. Y.

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VOL. V NEW YORK, AUGUST 20, 1917 No. 22

VALUABLE DECISIONS REACHED BY INTERNATIONAL AIRCRAFT STANDARDIZATION COMMITTEE

THE International Aircraft Standardization Committee, organized to standardize the specifications for the metals that go into making aeroplane parts as well as the metal parts themselves, met at 25 Pine street to-day.

The following gentlemen attended the meeting: F. G. Diffin, late head of the Erie Specialty Company, chairman, representing the United States Government; A. B. Rogers and S. G. Payne, C. E., representing Great Britain; Captain Alexander Pomilio and Dr. McGregor, representing Italy; Captain Jean Herck and Captain D. E. Chanvalon and Lieutenant M. Mignot, representing France; Friehof G. Ericson, representing Great Britain; George L. Norris, representing the United States Signal Service Aircraft Engineering Division; Dr. George K. Burgess, representing the United States, Bureau of Standards, and K. W. Zimmerschied of the United States Aircraft Standardization Committee.

The committee reached many important conclusions which will assist in increasing the production of aircraft in large quantities, some of which are as follows:

(1) As aeroplane uses are international in character, and the United States is to a great extent to be the source of supply of metals for aircraft as well as the aircraft parts themselves, there is immediate need of standardization of all metals, aircraft parts and function thereof as far as possible.

(2) If this production on a large scale is to be obtained, it is essential to eliminate the loss of time and output and the additional cost involved in manufacturing many metals which are not now standards in the mills of the United States. It is also necessary to adjust the parts on all machines to a single standard as far as possible in order that production may be uninterrupted.

(3) The Committee arrived at definite decision as to the kind of steel to be used in the making of aircraft parts. The details regarding this cannot be made public.

(4) An agreement was reached which will lead to an ultimate agreement to adopt uniform specifications for metals used by different countries for specific purposes.

Mr. F. G. Diffin, the chairman of the Committee, said:

"Marked results were achieved in initial meeting. We have arrived at definite decisions which will greatly hasten the construction of the thousands of aeroplanes needed to strike Germany through the air.

"It is the purpose of the Committee to work out the standardization of metals first and we are rapidly working for the same results in every detail of construction of aeroplanes. The result of this will be an enormously increased production and added efficiency in production.

"The results to be obtained by such quantity production is what the Allies are looking for—the supremacy of the air, which is to decide this war."

The meeting was adjourned to be held again in Washington. A meeting will be held at least once a week until results sought for are accomplished.

Senators Favor Aircraft Board

The Senate Committee on Military Affairs ordered a favorable report on the Sheppard bill creating an Aircraft Board to consist of the Chief Signal Officer of the Army, the Chief Constructor of the Navy and not more than five expert civilians.

As amended in the Senate committee, the bill would empower the proposed Aircraft Board to "supervise and direct, in accordance with the requirements prescribed or approved by the Departments of War and Navy respectively, the purchase, production and manufacture of aircraft, engines and all ordnance and instruments used in connection therewith."

A provision in the bill as introduced limited the authority of the board to make recommendations as to contracts, providing that "every contract shall be made by the already constituted authority of the respective departments." This provision was stricken out by the committee, thereby greatly increasing the power and authority of the Aircraft Board.

Provision is made in the bill for paying the civilian members of the board a yearly salary of $7,500. As introduced, the bill required members to serve without compensation. Provision is made for the employment of technical experts and other necessary employees at salaries to be fixed by the board.

Senator Chamberlain, chairman of the Military Affairs Committee, announced that he would press the bill for passage in the immediate future. It is predicted that the measure will pass the House in record time and without serious opposition. It is regarded as of high importance by Secretaries Baker and Daniels and Chairman Coffin of the present board.

Board is Speeding Up Aircraft Production

The Aircraft Production Board is devoting its energies to the perfection of its organization, pending the passage of the bill giving the board a legal status. Chairman Coffin has been in the West the past few days conferring with automobile and other industrial concerns.

The board has moved to the old Southern Railway building opposite Union Station, where two entire floors have been taken over. Ultimately the entire building, containing several hundred rooms, will be utilized.

Aircraft the Remedy for U-Boat Menace

In response to a request for a statement apropos of the third anniversary of the war, with special reference to the parts to be played therein by the United States and England, Viscount Alfred Milner, the widely known diplomat and statesman, indorsed most cordially the cooperation which America will render in the securing of aerial supremacy for our allies. He said:

"The thing that needs to be developed with the utmost energy—namely, aircraft, air services and air strategy. After many vicissitudes the Allies on the west front now have got something like the upper hand in the air, and by painful effort still continue to maintain it. But that is not enough. Complete supremacy in the air is certainly attainable through the united and maximum effort of the United States, France and Great Britain. They should be satisfied with nothing less, for this alone would be decisive. Ten thousand additional aeroplanes may well be worth more than half a million or even a million men, and they are easier to transport. But here again everything depends upon realizing the extent of the need and to see that the task before us is as big as it really is. That is the first thing needful, and the second is like unto it—to hurry up and act in close concert with one another in all our preparations so that there may be no waste, no overlapping. Distance places many obstacles in the way of continuous consultation and pulling together. These are our greatest difficulties, but they can be greatly minimized by the proper organization of councils of the Allies."

Waiting For Air Supremacy

(*Editorial in N. Y. Globe*)

The British in Flanders, having wrecked some fifteen miles of the German front, having killed a large number of defenders, and having captured several thousand prisoners, seem content not to attempt further. The operation, nibbling on a huge scale, partakes of the nature of the movements in front of Bapaume, Arras, and the Messines ridge. It does not seem the British plan at present to break through the German line and convert the struggle from a tactical to a strategical one.

It is likely, almost certain, other great attacks will be made before winter. One in front of Lens seems now in its first stages. But the evidence is that they will be against particular objectives and not for larger ends. "Smash, smash, smash—this seems the Haig policy for the present. And it has been sufficiently demonstrated that the Germans are not strong enough to make successful counter-attacks.

The further postponement of the "big push" leaves little doubt unless internal conditions in Germany effect a great change the war will last through the winter until next spring. The Allies have seemingly concluded to wait until they have established an air supremacy comparable to their present artillery supremacy. To this country is assigned the main business of providing the aeroplanes and the men to operate them. If we measure up to the burden imposed on us, if we spend wisely the huge credit that Congress has voted, America will play a decisive part even though no considerable part of our army ever gets into actual action.

The War Department has refused to allow the creation of a separate air service department, opposing the efforts of Congressman Hulbert and others in this direction. The air board, one may assume, will thus be hampered by the punctilio of our war bureaucrats—their aversion to doing anything rapidly through fear of violating regulations or of making mistakes. In the name of thousands of young Americans whose lives and limbs will be unnecessarily sacrificed if there is a "fall down" in airship building as there has been in shipbuilding, let us hope the experts of the War Department will for once conquer their defect and not get altogether in the way of the men who want to get things done.

To Expedite the Aircraft Project

(Editorial in New York Tribune.)

It is reported that one of the great aircraft corporations is to receive an immediate advance of $11,000,000 in order that there may be no delay in carrying out the vast enterprise which may contribute so materially to the shortening of the war.

Apparently it is the intention of the government to deal liberally with all responsible companies that require an augmentation of working capital to meet present needs, and thus to provide against the loss of time inevitably caused by borrowings in the open market through the issuance of securities.

This is gratifying news. Success in the war depends more and more on supremacy in the air, and there is no time to be lost if we are to make good. We have lost enough time already in the building of ships, and it would be deplorable indeed if more were to be thrown away on this urgent occasion.

The apprehension that some one may possibly make a bigger profit than he is entitled to is, of course, understandable and laudable enough in its way. No doubt profiteering is one of the evils to be guarded against in time of war; but such mutual suspicions, when they become epidemic and habitual, are paralyzing. Our present need is a great air fleet, and there should be no needless delay in completing the work for which so splendid a provision has been made.

Large Bombing Aircraft Doing Excellent Work

The value of large aeroplanes is being emphasized daily by the wonderful achievements of the Italian aviators. The following are a few excerpts from official bulletins:

> Yesterday morning our air squadrons, accompanied by escorting planes, returned to the Chiapovano Valley to renew their bombardment of the military works there. Having dropped more than four tons of torpedo incendiary shells and obtained direct hits on their objective, all our battle-chasing machines returned safely.

Italian Headquarters, August 5.—The Italians are launching against the Austrian naval port of Pola vast and startling flights of giant Caproni aeroplanes, each with a crew of four or five men, and as if to place upon the enterprise the final cachet of Italian perfection, with each raid there travels in the leading machine the single man whose words and gestures are followed breathlessly throughout the country, Gabriele d'Annunzio, the acclaimed poet of the Italians. The Austrians, too, have been raiding lately, sprinkling bombs on many inland villages far from military objectives.

The Italian raids upon Pola during the nights of August 2 and 3 were not merely reprisals for many useless murders, but an assault upon the nest of submarines, airships, aeroplanes and war vessels with which Austria seals the entry to the Gulf of Trieste. The results, which are yet to be confirmed and tabulated, are surely great. I have heard the statement of an aviator who took part that Pola as a naval base is already extensively damaged.

The first raid was carried out by thirty-six machines, including fast fighting machines, which escorted the great Caproni bomb droppers. It was like watching a flotilla of destroyers go to sea as the great machines moved off at four-minute intervals, taking up a perfect alignment against the sky. Motorboats were out to guide them to the Austrian coast, for there was a fog over the sea. Before midnight the squadron was over Pola, maneuvering amid a tangle of searchlight beams and a hurricane of shots from panic-stricken gunners in the city's defenses. Bombs ranging from 70 to 200 pounds were raining down on the arsenal, dockyard and anchored ships.

The First Flight

By E. VINE HALL.

"I will try the first flight at my own hazard."—Johnson's "Rasselas."

At the breaking of the day.
Loosed from land we start away,
With unhesitating leap
Launched upon the tideless deep,
And dizzy spaces of the air;
Sailing on an ocean bare
Of breakers, yet disturbed and crossed
With crazy currents, whereon tossed,
E'en the stoutest aircraft reels,
E'en the bravest earthman feels
The impotence of wing and wire,
Of strut and stay, as ever higher
To circumnavigate the blast
He soars, and deems each mile his last.

So at my hazard I essay
To pierce the liquid light of day;
Swiftly upon the sky we creep,
Surely on our voyage sweep,
Up the pure unbroken height
Denizened by cloud and light
Only, and no living thing
Save ourselves upon the wing.
How my heart with rapture fills,
And with exultation thrills!

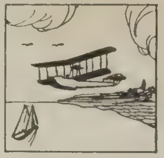
Borne with wild, unfettered pace,
On a strange, resistless race,
To no port that eye can see,
Through the desolate country,
The unpopulated plains,
Where primeval silence reigns,
Of mid-air. At first with fear
I beheld the pilot steer
Upwards, till my soul was wrought
Rapt as one is rapt in thought,
Out of space and out of time,
Unto altitudes sublime,
Where the sight fails, and one sees
Spiritual mysteries.

Here upon our dazzled eyes,
We might see the towers rise
Of the city of the saints;
Here, where nothing earthly taints,
Nothing unsubstantial seems
Of man's visionary dreams.
Souls might hither fly and fare,
Spirits haunt this upper air.

Ah! but how shall I sustain
To breathe the lower air again?
After the rapture and the race,
How resume a mortal's place?
After the height the dusty day,
After heaven the common way?

—*In the Literary Digest.*

The News of the Week



Samuel S. Bradley Appointed General Manager Manufacturers Aircraft Association

At a special all-day session of the Manufacturers Aircraft Association, Inc., held in the rooms of the Old Colony Club, Hotel Raleigh, Washington, D. C., on August 8th, Samuel S. Bradley, a well-known Brooklyn business man, was appointed general manager.

It was explained by Mr. Frank H. Russell, President of the Association, in an interview with a representative of the AERIAL AGE, that this move was made necessary by the increasing activities of the Association and by the fact that important matters in connection with standardization and materials were constantly coming up at conferences between the Army and Navy officials and members, which seemed to necessitate a more intimate and continuous relation between the Association and directing heads at Washington. It was also felt that the appointment of Mr. Bradley as a representative of the Association would do much to facilitate the work of aircraft building and eliminate many delays which heretofore have been unavoidable, due to lack of daily co-operation with the various aircraft committees and boards in Washington. While Mr. Bradley's official headquarters will be at the offices of the Association, 501 Fifth Avenue, New York City, it is expected that much of his time will be spent in Washington, where it is felt that he can be of most value to the Government.

In compliance with the Government's request, aircraft manufacturers are withholding from publication all information and photographs which might be of value to the enemy. While this in a certain sense might seem to withdraw from public circulation much news matter of interest, yet at the same time it can readily be appreciated that with the rapid growth and development of the industry there will be many new features, the details of which should not be made public during the war. In order to protect these designs and retain for the Allies the supremacy of the air, a strict censorship may be exercised by the Government and by the manufacturers themselves.

It was also decided that employees engaged in the building of aircraft should be properly identified with their work. A design for an identification badge was adopted for which copyright has been obtained. These badges, which will be numbered and registered, are signed for by the employee and can only be worn during his connection with the industry.

Other important matters in connection with standardization and materials were discussed and acted upon. Frequent sessions of the Manufacturers Aircraft Association will be held in Washington with a view to aiding the Government authorities in the development of the aircraft service.

The following members of the Association were present: Judge W. Benton Crisp, General Counsel; Inglis M. Uppercu of the Aeromarine Plane & Motor Company; Frank H. Russell of the Burgess Company; Fay L. Faurote of the Curtiss Aeroplane & Motor Corporation; H. E. Talbott, Jr., of the Dayton Wright Airplane Company; Albert H. Flint of the L-W-F Engineering Company; Harry B. Mingle of the Standard Aero Corporation; Benjamin S. Foss of the Sturtevant Aeroplane Company; Frank L. Morse of the Thomas-Morse Aircraft Corporation; George H. Houston of the Wright-Martin Aircraft Corporation; Benjamin L. Williams, Assistant Secretary.

Stinson Makes Looping Record

Norfolk, Va.—The world's record for consecutive loop the loops in the air has been broken by Edward Stinson, aviation instructor at the Hampton Roads Aviation Station, near Hampton. With Mrs. Robin Gray of Norfolk as a passenger, Stinson performed this feat thirty-four times.

Stinson, who will probably go to the front with the national army when he has finished training a company of student airmen, rose to a height of 4,000 feet with his passenger. At that altitude he began the first loop and made the circle thirty-four times without a break before gliding down to the field, where he was congratulated by army officers. Stinson said before he went up that he intended to break the world's record.

U. S. Steel for All Allies' Aeroplanes

Washington.—The United States, in closest co-operation with the British, French and Italian Governments, will co-ordinate all industries entering into the great aviation programme upon which the Nation embarked with the granting by Congress of a $640,000,000 appropriation.

The Aircraft Production Board, acting for the Government, will arrange for the purchase of all aeroplane spruce and other wood entering into construction and distribute it to Great Britain, France, Italy and the United States in proportion to the needs of each country.

Ultimately all steel will be manufactured in this country, and distributed in the same way, releasing British, French and Italian steel for other war purposes.

Experts of great ability and resources are constantly at work improving motors and planes and devising entirely new features. This work not only will be continued, but greatly extended.

The principal thing now is to standardize absolutely every part that enters into the motor and every other part of the aeroplane, in order that plants anywhere can build the complete engines, complete machines or parts on identical lines, thus quickly reaching the quantity production stage, when they will be turned out with great speed.

Senators Inspect New U. S. Aeroplane Engine

Washington.—Members of the Senate committee on military affairs have been permitted by Howard E. Coffin, chairman of the Aircraft Production Board, to inspect the new engine which has been turned out for use of American aeroplanes.

This is the engine on the development of which Mr. Coffin and other experts, including some of the best automobile engineers of the country, have been working for some time. Tests are being made with satisfactory results.

Members of the military committee, though not disposed to give details concerning the engine — for obvious military reasons — are much impressed with the promise it gives of being of the effective type needed for war purposes.

American Commission in Rome

Rome.—The arrival of an official American mission of officers charged with the study of Italian aeronautics, the system of training schools and factories causes general satisfaction here. Since the war began Italy has made immense strides in this banch of the war, production in the workshops of Milan, Turin, and the neighborhood of Naples having increased almost incredibly, so that Italy has not only supplied herself with machines of excellent quality and power, but has been able partly to supply Russia and Rumania.

Colonel Mitchel, Major Bolling, and Captain Clark, the American envoys already realize how much has been done here and what an important branch of national industry aeronautics has become.

Aviators Thank Mrs. W. G. McAdoo

Mrs. William G. McAdoo, wife of the Secretary of the Treasury, has received a letter from Captain Chenault, commandant of the La Fayette Flying Squadron in France, expressing thanks for an American flag made by women employes of the Internal Revenue Bureau of the Treasury. Here is a translation of the letter, which was written in French:

"Escadrille (Squadron)
"No. 124 La Fayette, S. P. 181.

"Madame:—In the name of all my pilots, I thank you for the flag which you have had the kindness to send us.

"Embroidered by your hands and those of your compatriots, it is a little of the heart of America that has come to us.

"We have been profoundly touched, and the 7th of July, the day on which the flag was officially delivered to us, will stand out in the calendar of the Squadron.

"In the name of L'Escadrille La Fayette, I offer you all our thanks and our respectful homage, and rest assured, Madame, that our standard will wave over fields of honor and of glory.

(Signed) "CHENAULT,
"Captain Commandant l'Escadrille La Fayette."

McCall White Returns to Cadillac

D. McCall White, who resigned as chief engineer of the Cadillac Motor Car Co., Detroit, during the last few days of the Leland administration, has returned to his old office at the request of R. H. Collins, the new president. Following Mr. White's resignation no chief engineer was appointed and his old organization was continued except that he was not present to head it. Under these circumstances he virtually succeeds himself and continues with his own policies. During Mr. White's temporary absence from the engineering chair of the Cadillac Company he has been acting in a consulting capacity to all of the General Motors sub-organizations under the leadership of W. C. Durant.

Akimoff Organizes Dynamic Balancing Laboratory

Philadelphia.—N. W. Akimoff, inventor of several advanced types of dynamic balancing ma-

The Gallaudet Aviation Camp at East Greenwich, Rhode Island.

chines, is organizing a special dynamic balancing laboratory here. Its primary object will be to serve for demonstration purposes and acceptance tests, although Mr. Akimoff is also planning to handle a limited amount of outside work in connection with the dynamic balancing of shafts, etc. Such work is done on his own machines and under his personal supervision.

First Naval Militiaman to Pass "Naval Aviator" Tests

Landing and planing upon a three-foot wave terminated a series of tests, successfully executed by Lieut. C. E. Ruttan, Aeronautic Division, First Battalion, Naval Militia, N. Y., stationed at Bay Shore, L. I.

A speedy little boat containing the judges (Lieut. Johnson, in charge of Naval Training Stations, and Lieut. Read, in charge of the Bay Shore Station), shot out and made its way toward Fire Island Light and the inlet. Half an hour later a seaplane followed, rose to 2,000 feet and caught its leader as it neared the inlet, then snaking its way from side to side kept at a respectful distance to the rear until the boat was well out in the ocean swell.

A Southwesterly wind of 20 miles piled the rollers up to four and a half feet, which drenched the occupants of the little craft, then it stopped, and the seaplane immediately came into a glide which ended 50 feet abeam. As the machine flattened out it seemed to pitch slightly, then keep pace with the waves, the step and tail of the pontoon took the water together, the motor started to roar again and the machine actually planed for fifty feet or more, when it took the air, kissing the first four or five waves as it left—it was done.

This was the last of a series of tests consisting of altitude, cross wind, buoy landing and rough-weather work, the first qualifications being forty hours in the air.

Lieuts. Lee H. Harris and C. E. Ruttan have to their credit between 80 and 100 hours each, and have been instructing in flying, aerodynamics, seaplane construction, motors, magnetos and carburetors, at the U. S. N. Air Station, Bay Shore, L. I., which now numbers about 150 officers and men.

The development of the little air station which they started at that place last summer and brought to a point where it was taken over and is now controlled by the Navy Department, was due to patriotic financial aid and hard work, and it is quite probable that it will be one of the biggest seaplane stations in the country.

New England Aviation News

Since July 20th New England has sent to Washington 25 per cent of all applications received for commissions as First Lieutenant in the Aviation Section of the Signal Officers Reserve Corps, as aviators and observation balloon pilots.

It has been stated that the United States requires 25,000 airmen, such as aviators and balloon pilots, to do their bit in the Great International War.

New England quota on a basis of population is as follows:

Maine	170
New Hampshire	100
Vermont	80
Massachusetts	833
Rhode Island	135
Connecticut	275
Total	1593

Or in round numbers—1600.

The aviation section of the Signal Corps was established in the Northeastern Department about July 17th. Since this department came into operation, it has had the unlimited support of the press throughout New England and the personal assistance of the Governors of each State and the mayors of cities, and the heads of universities and colleges.

The Aviation Section of the Signal Corps undoubtedly offers the best positions of the service. All aviators and balloon pilots when they graduate following a training of six months, are commissioned as First Lieutenants in the Reserve Corps of the Army, at a base salary of $2,000 annually when on duty, with additional compensation when in active service at home or abroad, and during tuition, they receive soldiers' pay, rations and lodging, also expenses to the schools and training camps.

It is not the intention of the Northeastern Department to stop when its ratio quota, 1,600 is received, but to continue and show the rest of the United States that New England can furnish a greater number than its quota of men of fine sterling qualities to serve their country as aviators and balloon pilots.

To accommodate the large number of clerks and others desiring information regarding America's Aviation Army, the Aeronautical Headuarters at 25 Huntington Avenue, Boston, will be open Wednesday, Thursday and Friday evening of this week from 8 until 10, also Saturday afternoons.

Army and Navy Orders

Capt. John Sloan, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the constructing quartermaster, aviation experimental station and proving gorund, Hampton, Va., for duty as assistant superintendent of construction at Langley Field.

1st Lt. W. L. Saunders, S.O.R.C., aviation section, report to commandant School of Military Aeronautics, Cornell Univ., Ithaca, N. Y., for duty.

Maj. B. D. Foulers and Capt. T. DeW. Milling, J. M. Aviators, Sig. Corps, report to the President of the board appointed in order of July 19, for examination for rating as military aviators.

Capt. Eugene Lazar, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding officer, United States Army Balloon School, Fort Omaha, Nebr., for assignment to duty.

Capt. Thomas G. Gallagher, Av. Sec., S.O.R.C., report in person to commanding general, S.D., for duty. (July 31, War D.)

Capt. Eugene T. Bernart, Av. Sec., S.O.R.C., report in person to C.S.O. of Army for duty. (July 31, War D.)

Capt. Ogden L. Mills, Av. Sec., S.O.R.C., to report to Chief of Staff, Washington, for temporary duty in his office. (July 31, War D.)

Capt. John J. O'Connell, Av. Sec., S.O.R.C., to duty in office of C.S.O. (Aug. 1, War D.)

Capt. Marshall F. Mills, Av. Sec., S.O.R.C., to duty in office of C.S.O. (July 31, War D.)

First Lieut. Porter A. Mackall, Av. Sec., S.O.R.C., to duty at Mount Clemens, Mich. (July 31, War D.)

The following officers of Av. Sec., S.O.R.C., to duty at Fairfield, Ohio: First Lieuts. Robert Bartholomew, Dudley S. Norton and David B. Lindsay. (July 30, War D.)

First Lieut. John C. Farrar, Av. Sec., S.O.R.C., to duty in office of C.S.O. of Army. July 31, War D.)

First Lieut. John Mitchell, Av. Sec., S.O.R.C., to duty at Rantoul, Ill. (July 31, War D.)

First Lieut. Walter L. Saunders, Av. Sec., S.O.R.C., to duty at Cornell University, Ithaca, N. Y. (Aug. 1, War D.)

A board of officers composed of Major Henry H. Arnold, S.C., U.S.A.; Capt. C. G. Edgar, S.C., and Lieut. Col. George H. Crabtree, U.S.A., retired, has recommended to the Chief Signal Officer of the Army that a two-squadron unit ground school and aviation field be established at Memphis, Tenn., upon a site offered for that purpose. The land comprises about one square mile which is for rent at $10 per acre; the existing buildings are valued at $17,600, and the growing crops at $25,000. Absolute title could be secured for $87,425. The Memphis Chamber of Commerce agreed to supply telephone, telegraph and railroad connections to the site and to furnish suitable landing grounds in the immediate vicinity.

Numerous Flights and Routine Work Are Conducted at Various Aviation Camps

The Aviation Section of the Signal Corps of the Army authorizes publication of the following information pertaining to aviation matters:

Minneola, N. Y., July 21, 1917. Five hundred thirty-nine flights were made during the week, totaling 222 hours 12 minutes. The following completed their R. M. A. tests; Private W. S. Savalle, A. S., S. E. R. C.; Corp. J. J. St. Croix, 2d A. S. S.

San Diego, Cal., July 14, 1917. Five hundred eighty-six flights, totaling 265 hours 34 minutes, were made. Lieuts. Walton, Hoffman, Emmons, and Lyon were recommended for rating as T. M. A.'s. Sous Lieuts. Robert Mayresse and Henri Marquisan, French pilots, reported for duty as flying instructors and lecturers. Classes were conducted in flying, aero engineering, radio, for officers; and aero motors, radio flying, and construction and repair of airplanes for enlisted men.

Corregidor, P. I., June 16, 1917. Routine work occupied the major portion of the time, though four flights were made totaling two hours' duration.

Camp Kelley, San Antonio, Tex., July 28. Eighty-five flights were made during the week, the total time consumer being 48 hours and 17 minutes.

39 More Airmen Graduated

Champaign, Ill.—With the graduation of thirty-nine student aviators from the University of Illinois Ground School next Saturday, nearly 100 men will have completed the preliminary instructions in aeronautics here. The group is the largest yet to be graduated. Students are arriving at the rate of fifty a week.

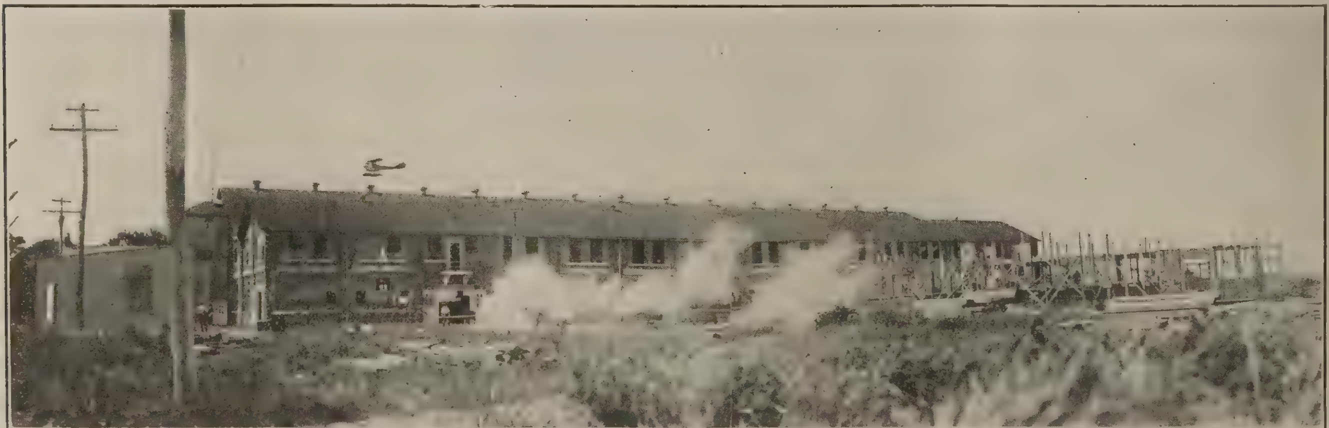
Wrecked Zeppelin Brought Here

New Yorkers may soon see the remains of a Zeppelin shot down in one of the German raids over London. Custom House authorities gave up yesterday the attempt to classify for duty the wrecked airship and sent the papers to the Board of General Appraisers.

The wreckage, which in its fall carried to death a crew of more than thirty Germans, arrived in the hold of a cargo steamer recently in cases, excepting the sections too large to be boxed.

The tariff law makes no classification of airships, but under a ruling of the Treasury Department airships and aeroplanes may be entered free under bonds for racing. The customs examiner reported that the Zeppelin, in the form in which it reached New York, appeared to be composed almost wholly of steel and aluminum, and recommended that duty be taken at 20 per cent. ad valorem as a manufacture of metal "not specially provided for."

The importer, whose identity is not revealed, set up the claim that the wreckage should be admitted at 2 cents a pound as "aluminum scrap," with an alternative claim at 3½ cents a pound as "aluminum in bars, strips, rods, &c." As no agreement was reached, the importer paid the duty demanded and will submit testimony to the Board of General Appraisers.



The rapidly expanding factory of the Aeromarine Plane and Motor Co., at Keyport, New Jersey.

Aviator Lane Assigned

The following order was issued July 18, 1917, and will be recognized as of that date:

1. First Lieut. Franklin K. Lane, jr., Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Rantoul, Ill., and report in person to the commanding officer, Signal Corps Aviation School at that place, for duty.

2. First Lieut. Charles F. Littlejohn, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding officer, Signal Corps Aviation Station, Mineola, Long Island, N. Y., for duty.

3. First Lieut. Brackett O. Watkins, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will report in person to the commanding officer, Signal Corps Aviation Station, Mineola, Long Island, N. Y., for duty.

U. S. May Buy Big Bombing Aeros

Washington.—Plans for the manufacture in this country of powerful British type bombing airships, to be used by the American flying corps, were discussed at a conference between W. H. Workman, British aero expert, and members of the Aircraft Production Board.

One machine of the type (the Twin-Motored Handley-Page) which it is proposed to manufacture has made a flight from London to Rome. Only the need of the British government for all its military machines at home and at the front, Mr. Workman said, had prevented an attempt before to make a transatlantic flight.

One of the machines, Mr. Workman told the Aircraft Board, has a record of having carried twenty-two men at an altitude of 7,180 feet. These machines took a large part in the British raids on the German bases at Ostend, Zeebrugge and Bruges, Belgium.

Four Aeroplanes in Head-on Collision

San Diego, Cal.—One of the most novel mishaps in the history of aeronautics occurred at Rockwell Field, North Island, August 11, when four military aeroplanes met in a head-on collision. The pilots of the four aeroplanes, all of whom were cadets from the Ground School of the University of California, escaped with slight injuries.

The aeroplanes were badly damaged. The rudders, elevating gear and wing sections were ripped and smashed.

The unique accident is attributed to the failure of two of the pilots, descending at tremendous speed with their machines, to keep a sharp lookout for aeroplanes below. Two of the aeroplanes, Nos. 97 and 99, were standing near each other preparing to go aloft, when Nos. 96 and 102 caught them broadside on. The four machines came together with a crash and were piled up in an indiscriminate mass. Both collisions occurred almost simultaneously.

This is the first mishap at Rockwell Field since two aeroplanes collided in midair five weeks ago. The first class of reserve military aviators, composed of university cadets, will begin graduating exercises at North Island to-morrow. Seven National Guard officers, the last that will be trained at North Island for the rank of junior military aviator during the duration of the war, were graduated Friday. The officers are from Washington, Oregon, Nebraska, Indiana and New Mexico. The training will now centre on those endeavoring to qualify for the grade of reserve military aviator. Graduating classes will be formed weekly.

Du Pont Aviation School Expanding

Wilmington, Del.—Seventeen more students have joined the du Pont aviation school at Claymont, a suburb near here. This brings the class now receiving instructions there to a total of twenty-five. All the students are candidates for the Government air service and before entering the school signed applications for enlistment in that branch.

The school is a private institution endowed by Pierre S. du Pont, Irene du Pont and John J. Raskob, president, vice-president and treasurer respectively of the du Pont company, and is free to all students who wish to qualify to serve the United States in the air corps. Harry N. Atwood, American aviator, and Tommy Birt, former member of the British Royal Flying Corps, are instructing the men.

The students, most of whom are college men, are William H. Bard and Lambert Sternberg of Reading, Pa.; Allen W. Carpenter, Matthew J. Deaning, W. B. Denham, Thomas W. Eaton, Roland K. Reed and E. G. Talman of Wilmington, Del.; W. M. Cushing, Frank Nelms and Charles Reinhart of Philadelphia, J. Frederick Gibbs of New York City; Walter Joseph of Smyrna, Del.; N. Paul Knauer of St. Peters, Pa.; Robert Mills, Pottsville, Pa.; Charles H. Randall, Weehawken, N. J., and Augustus F. Witt, Hillcrest, Del.

Robert H. Sexton, Jr., on the left, with his instructor, now training at Long Beach, Ontario, for the British Royal Flying Corps.

Applicants for entrance into the school now total nearly 300 and the managers are trying to get more planes to increase the facilities.

100,000 Needed for Aero Corps

The Military Training Camps Association of the United States is to co-operate with the Army Signal Corps in a nation-wide recruiting campaign to secure men for the aviation division.

About 100,000 men, it is said, will be required in the great aerial divisions advocated by the Hearst newspapers. Of this number approximately 20,000 will be officers.

Captain Arthur F. Cosby, executive secretary of the association said its 2,000 branches in all parts of the country will be at the Government's disposal as recruiting offices. The association, which was largely instrumental in making the Plattsburg and other training camps successful, decided on this action after receiving a request from the War Department.

The offices will not actually enlist men, but will furnish all information, receive applications and act as intermediary between the applicants and the Government. The office at No. 19 West Forty-fourth street is prepared for a record rush of young men.

Only those between the ages of nineteen and thirty years will be enlisted in the corps. The Government has decided to relax its requirement of a college, technical school or equivalent education, as it desires to get fliers quickly.

Men accepted for the preliminary eight weeks' training course will be ranked as privates of the first class and will receive pay and allowances of that rank during the time.

Every applicant must enlist as a private and be trained, the procedure being as follows:

A. If it is shown that the applicant possesses the qualifications required by the department's regulations, steps are taken to have him examined.

B. If the examination is satisfactory, the applicant is enlisted as a private, first class, in the Signal Enlisted Reserve Corps and sent to a training school for preliminary instruction. This course takes eight weeks, and during that time the applicant receives the pay and allowances of a private.

C. Upon the completion of the preliminary course the applicant is sent to an aviation school for instruction in flying. If he finishes the course satisfactorily he is commissioned a First Lieutenant in the Aviation Section of the Signal Officers' Reserve Corps.

How Officers Are Grouped.

Aviation officers are divided into three classes, as follows:

1. Flyers—Men between nineteen and thirty years commissioned as First Lieutenants, after finishing a three months' course.

2. Non-Flyers—Men between thirty and forty-five, who act as supply officers for air squadrons and rank as Captains or First Lieutenants.

3. Observation officers—Men qualified to be observers from aeroplanes. Candidates should be from twenty-five to thirty-five years, of good education, physically fit, with keen eyesight and ability to draw, and if possible have previous military experience. It is intended to assign successful candidates to a school for three to four months' instruction. This course will cover study in artillery fire from aeroplanes, reconnaissance, photography, radio operation and bomb dropping.

One of the motor assembly rooms of the Thomas-Morse Aircraft Corporation.

INSTRUCTIONS FOR ASSEMBLING CURTISS STANDARD JN4-B AEROPLANES

1—Packed for Shipping

THE component parts of the standard JN4-B are packed for shipment in two cases. The case is designated by the name of its major contents, as:

(1) Fuselage.
(2) Panels.

The contents of these boxes are noted on the packing sheets. Sample packing sheets are illustrated in Figs. No. 14 and No. 15.

(1) The fuselage contains the motor set in place; the instrument board and instruments all connected up; the carburetor control and adjustment; throttle control; spark advance control, and magneto cut-out switch; all connected up and ready for operation; and the tail skid in place. The control bridge is in place. The leads attached to drum and wheel of bridge, for operating the ailerons, will be found wrapped around the seat rails; the leads for controlling the elevators will be found attached to the sides of the U bridge, with ends passed through the fairleads and coiled up in the fuselage back of the pilot's seat. The rudder control wires are attached to the foot control bar, and leading to the rear end of the fuselage cover, are coiled up ready for leading through the fuselage for attachment to the rudder.

The landing gear, completely assembled without the wheels, and with the cross-stay wires connected up but slack, is also packed in this case. The wheels of the landing gear, the propeller and exhaust equipment will also be found in this box.

(2) The panel box contains all the panels with sockets and hinges all attached. The transverse and longitudinal wires will be found attached to the under side of the upper wing, coiled up and ready for attaching to the lower wing. The aileron control pulleys are all in place on the under side of the upper wing; the aileron control cables are passed through these pulleys and coiled up—shackles and pin at one end for attaching to the control pylons of the aileron, and turnbuckles at the other end for attaching to the "lead" coming from the control bridge and through the side of fuselage. This case also contains the elevators and rudder, with control or operating pylons removed. All the control or operating pylons for the ailerons, elevators and rudder are packed in this case. Also, all the panel struts and engine section struts are packed in this box. The details of contents are given in the packing lists, marked "Panels."

2—Handling

In handling and hoisting these shipping boxes, care should be taken when using a sling that the center of the lift comes somewhat ahead of the center of the box. This point can be quickly determined by trial, by lifting the bridle until the box rides level.

3—Opening Boxes

The case should be placed on the ground or floor, on a firm bearing over its entire length. *Care should be taken to have the part marked "Top" uppermost.* This will avoid the possibility of wrenching the motor from its bed; also the necessity of turning the fuselage over. The top may be readily recognized by the construction: not having any metal straps tying it down. The top should be carefully pried loose with a crow-bar or similar tool. Then carefully remove the side and ends of the box. The bottom side and temporary struts of the packing case are left in place under the fuselage until ready to assemble the running gear in place.

The propeller, wheels and other parts packed in this case should be removed from the members of the packing case to which they are secured.

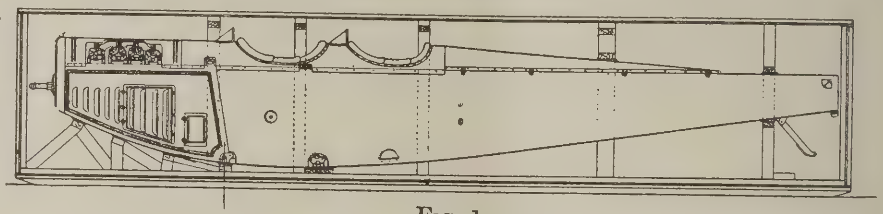


FIG. 1

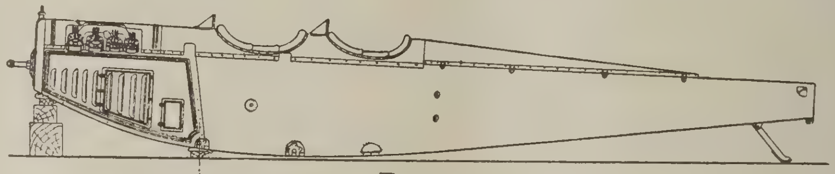


FIG. 2

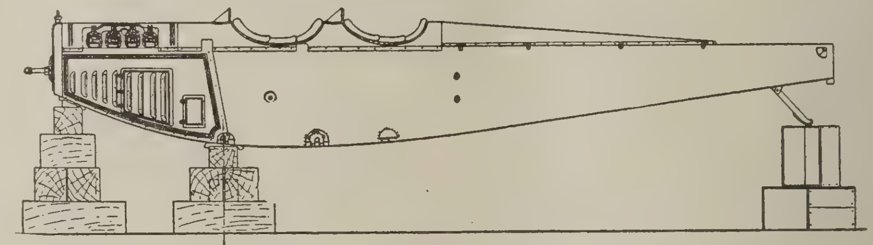


FIG. 3

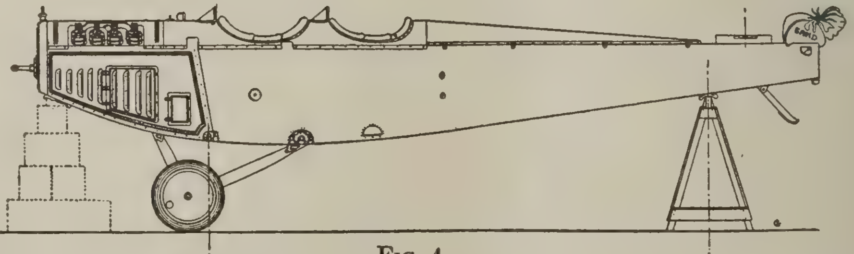


FIG. 4

4—Landing Gear Assembly to Fuselage

The landing gear (Part No. 5114; also see drawing No. 12251) is assembled by mounting the wheels on to the axle, and bolting wheels in place with bolts No. 4173-18 and accompanying nuts and cotters. The fuselage should now be elevated to receive the landing gear. This may be accomplished in one of two ways—either by tackle; or by shims and blocking.

(*a*) If block and tackle are used to raise the fuselage, pass a line under the engine bed supports or sills (Part No. 2881; see Drawing No. 12083) just to the rear of the radiator. To this line attach hook of block. DO NOT ATTACH LIFTING DEVICE IN ANY OTHER MANNER, TO AVOID DAMAGING OR CRUSHING SOME PART. With the fuselage now resting on its attached tail skid, lift the front end until the lower longeron clips for attachment of landing gear struts clear the landing gear. These clips on the lower longeron for connecting the front struts of the landing gear are found at Station No. 3 (see Drawing No. 12083). The clips on the lower longeron for connecting the rear struts are found at Station No. 5 (see Drawing No. 12083). The short bolts, with lock-washers, nuts and cotters, are found in the clips attached to the bottom longerons at Station No. 3 and Station No. 5. The lock-washers are put under the head of the bolt, and when the clips on the longerons line up with the clips on the ends of the struts of the landing gear, these bolts are passed down through the holes thus aligned. This places the nuts on the down side of the connection, thus facilitating assembling and inspection of connections. The castellated nuts are then put on the bolts and drawn up tight, until the drilled hole in the bolt is visible through the castle of the nut. Then insert cotter pin and spread the two leaves backwards over the nut. This locks the nut in place. When the landing gear has been completely assembled to the fuselage, the tail of the machine should be elevated and supported by a horse and blocking under Station No. 10 (see Drawing No. 12083), until the upper longeron is level. This can be determined by placing a spirit level on the upper longeron, between Station No. 10 and No.

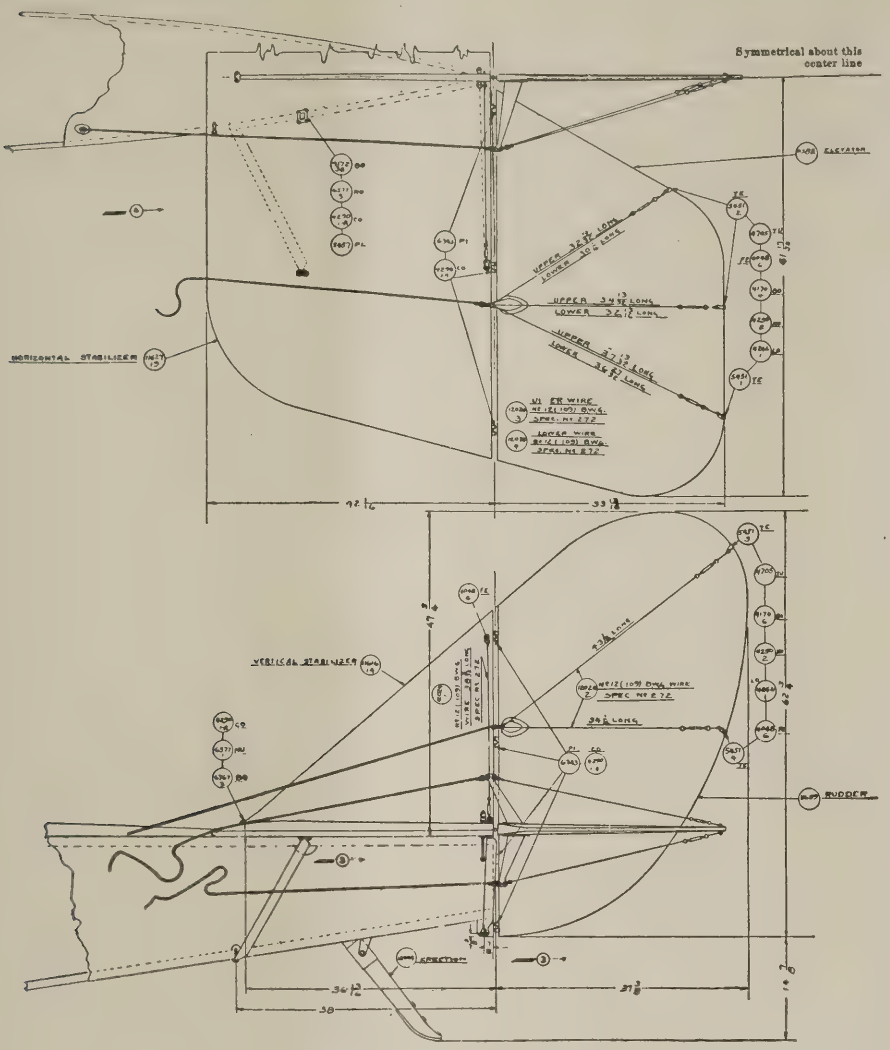


Fig. 5

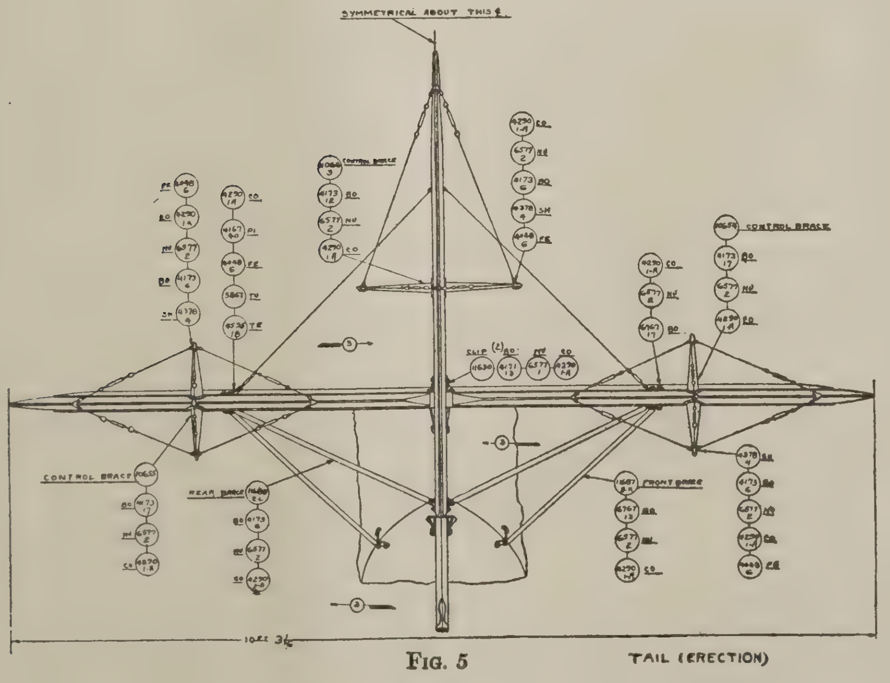


Fig. 5 TAIL (ERECTION)

12, at the tail or on the two engine bed sills (see Fig. No. 4).

(*b*) The other method that may be employed for raising the front end of the fuselage, to assemble the landing gear, is the following: remove the shipping blocking and front flooring of shipping case from under the fore part of the fuselage. Insert a block under the bottom longerons at Station No. 4, thus coming ahead of the point on which the fuselage is resting, as shipped. This blocking should be aligned under the vertical strut (see Fig. No. 1). The flooring to the rear of the blocking should now be removed. By lowering the tail, the nose of the machine is elevated, the above mentioned blocking serving as a fulcrum. Block up under nose of machine, placing blocking under RADIATOR-BRACKET, AND NOT UNDER RADIATOR (see Fig. No. 2). If the tail of the machine be now lifted, this nose blocking serves as a fulcrum, and the fuselage at Station No. 4 will clear the blocking at that point. Block up again with wedges under Station No. 4 until blocking is tight against lower longeron (see Fig. No. 3). By depressing tail of machine, the nose will again be elevated so that the blocking there will now need to be increased. By this alternating method of changing the fulcrum point and increasing the blocking, the nose of the machine can ultimately be blocked up sufficiently high (with tail of machine on the ground and blocking at Station No. 4 removed) that the landing gear may be assembled to fuselage, Figure No. 4.

5—Horizontal Stabilizer (Part No. 11627)

After the upper longeron is leveled up, the horizontal stabilizer (Part No. 11627) is assembled to the tail of the fuselage. From Drawings No. 12252 (Plan View) and No. 12024 (Fig. No. 5) the disposition of this member is shown. Each upper longeron has one U-bolt and four standard bolts, tied together in pairs on the under surface of the longeron by two connecting plates fastened to it. These bolts have the legs pointed upward, and serve to hold the horizontal stabilizer in place. These bolts are disposed as follows: One U-bolt is located just ahead of Station No. 9, and secures the leading edge of the horizontal stabilizer; the four bolts arranged in pairs are located approximately midway between Stations No. 10 and No. 11, and engage the front beam of the horizontal stabilizer. The horizontal stabilizer is aligned over these bolts, placing the washer plate (Part No. 5457) on the upper surface of the horizontal stabilizer, over the intermediate set of bolts between Stations No. 10 and No. 11; and the two bolts on each side of the tail post at the upper longeron level. The nuts are all drawn up tight, until the hole drilled in the bolt becomes visible through the castle in the nut, and cotter pinned.

6—Vertical Stabilizer (Part No. 11616)

The vertical stabilizer is now fastened to the horizontal stabilizer:

(1) By means of the bolts which pass through the forward and after parts of the horizontal stabilizer, and

(2) By means of the flexible stay lines running from the top of the vertical stabilizer to the upper surface of the horizontal stabilizer (see Drawing No. 12024). The forward bolts pass through the clip at the lower front point of the vertical stabilizer. The bolts which are fastened to the tail post of the fuselage, and engage the after end of the horizontal stabilizer, also engage the lugs fastened to the bottom edge of the vertical stabilizer at the rear. Draw the nuts up tight and lock with cotter pins. The flexible wire cables, attached to the vertical stabilizer, and turnbuckles are used to align and tie down the vertical stabilizer.

7—Rudder (Part No. 11659)

The control pylons or braces (Part No. 11066-3) are first attached to the rudder. These braces are so placed that the upper tips point toward the hinge line. In this fashion the holes will match up. The bolts and nuts for securing braces to the rudder are shipped and fastened to the braces. Before mounting the rudder the vertical stabilizer should be checked up, so that it is in plumb alignment with the tail post. This check is absolutely necessary to insure the absolute alignment of the hinges in the vertical stabilizer and the tail post. The rudder is now mounted onto the tail post and vertical stabilizer by means of the hinges. (See Drawings No. 12024 and 12251 for position and relations.) The hinge pins are now inserted in the hinges, and cotter pins passed through the drilled holes in the bottom of the pins. The cotter pins should be spread backward as usual.

8—Elevators (Part No. 11582)

These are first equipped with the control braces (Part No. 10654), which, with the accompanying bolts, nuts and cotters, are found in the Wing Panel Packing Box. The position of the base of the control brace is indicated on Drawing No. 12024 (Fig. No. 5). These braces are also arranged so that the upper tips point toward the hinge line. The elevators are mounted to the horizontal stabilizer by means of the hinges and hinge pins. The hinge pins are kept in their bearings by the cotter pins, inserted through the drilled holes in the bottom of the hinge pins. The position of the elevators are shown on Drawing No. 12024 (Fig. No. 5).

9—Panel Assembly

The panels are now to be assembled. Before the main panels can be connected to the fuselage, the engine section panel must be erected.

Engine Section Panel (Part No. 4773): The engine section struts are set into place into their sockets on the upper longerons. These posts are found packed in the "Panel" box. The forward posts (Part No. 12520) are approximately held in place by the flexible wire lines to be found coiled up and temporarily fastened under the cowl in the motor compartment. The rear struts (Part No. 12521) are approximately held in place by the flexible wire lines leading from the lower longeron, Station No. 7, and to be found coiled up under the aft-cowl. The engine section panel is now mounted on the struts, after the front transverse bracing, between the posts, is aproximately trued up. The engine section panel posts and wires are then trued up prior to further erection. This condition is obtained by adjusting all "mated" or similar wires to the same length.

10—Main Panels

The main panels are now to be assembled to the machine. There are two methods for accomplishing this:

(*a*) Assemble panels, struts and wires, before attaching to fuselage.

(*b*) Assemble the upper plane to the engine section, and complete assembly.

The first method is the most advantageous, since it permits the setting of the main panels at the approximately correct stagger and dihedral, and does not require as much subsequent adjustment as the second method.

(A) First Method—Wings Completely Assembled.

All the main struts will be found to bear a number. These numbers run from 1 to 8. The method used in numbering the posts is as follows: Starting as post No. 1, with the outer post on the left hand side of the pilot, as he faces his direction of travel, the front posts are numbered successively from No. 1 to No. 4: Nos. 1 and 2 being on the left side and Nos. 3 and 4 being on the right side. The rear posts are similarly numbered from No. 5 to 8: Nos. 5 and 6 being on the left and Nos. 7 and 8 being on the right. This system of numbering does not include the engine section struts. Fig. No. 6 shows the system graphically.

The system of marking also insures that the struts are not inverted in their sockets. This is accomplished by painting the number on the strut, so that when viewed from the pilot's seat all numbers can be read; i. e., the numbers are painted on that side of the strut intended to face the fuselage, as diagrammatically shown in Fig. No. 6. If a strut be inverted by mistake, it can thus quickly be detected.

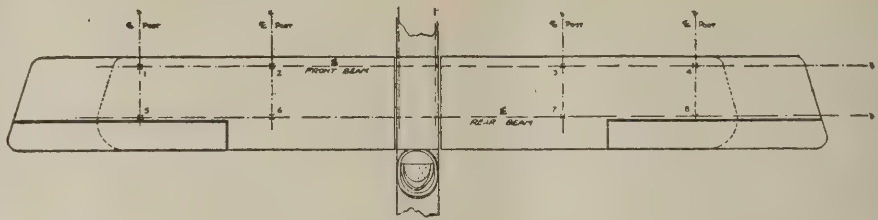


Fig. 6

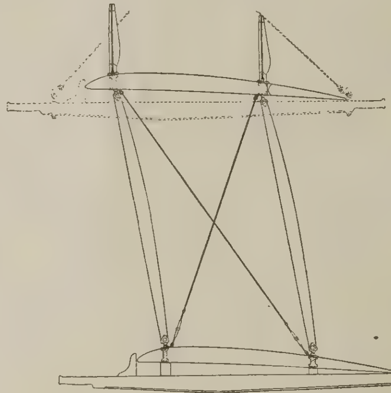


Fig. 7

(1) The upper left wing panel (Drawing No. 4771) is first equipped with the front and rear masts by inserting the masts into their sockets on the upper surface of the panel. The mast wires are then connected up to the anchor plates, located on the upper surface to the right and left of the mast-socket. Adjust the tension in these wires, by means of turnbuckles, until the front and rear wing beams become straight.

(2) Stand the upper left wing panel and lower left wing panel on their "leading" or "entering" edges, properly supporting the panels in cushioned blocks to prevent damage to the nose. Space the panels apart, approximately equal to the length of the struts.

(3) Next connect up the diagonal cross wires. These must be loosely connected up (by loosening up the turnbuckles), to permit the easy entering of the posts into the sockets. The wires are connected before the posts or struts are set in place, since, with the latter in place, the connecting of the wires to the lugs of the sockets is accomplished only with difficulty. After these wires are thus connected, insert the posts and bolts into place.

(4) Connect up loosely the "landing" (single) wires and "flying" (double) wires of the outer bay to hold the wings together as a unit. The outer bay is thus completely wired, though but loosely.

(5) The posts that are used for this left side are, according to the diagram, No. 1, No. 2, No. 5 and No. 6. No. 1 is the outer front; No. 2 the inner front; No. 5 is the outer rear; No. 6 the inner rear.

(6) The wings, as above assembled, are now erected to the fuselage. Extreme care should be exercised in transferring the wings to the fuselage, not to strain or break them. In carrying the wings, use wooden boards placed under the wings, and block up under the wing beams (which can be easily located by the line of fittings attached) so that these take the strain of the load. Do not attempt handling assembled wings, using the posts as carriers, or by attachments to the trailing or leading edges. Fig. No. 7 shows a good manner in which the panels may be shifted.

The wings should be firmly supported temporarily by a suitable sling at the upper outer post point (not beyond this point), or by a horse, properly blocked under lower wing at outer lower post point (not beyond this point), during fitting of wing to machine. See Fig. No. 8 for arrangement. The wings will have the approximate stagger if assembled as above, since the posts are in place and the tension cross wires are adjusted to almost correct length when shipped. Insert the hinge pins through the hinges, located at 1 Fig. No. 8, as now coupled up

(*To be continued*)

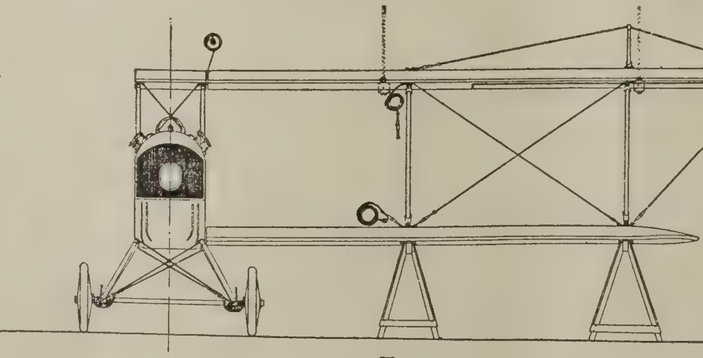


Fig. 8

NATIONAL PHYSICAL LABORATORY REPORT FOR 1916-17

THE annual meeting of the General Board of the National Physical Laboratory was held at the Laboratory at Teddington, Eng., June 19th. The President of the Royal Society (Sir J. J. Thomson) is chairman of the board, and Lord Rayleigh is chairman of the executive committee.

The laboratory staff has been largely augmented during the past year, and its activities have comprised widely diversified fields. We present herewith a precis of the aeronautical reports.

The Effect of Surface Roughness on the Heat Transmitted from Hot Bodies to Fluids Flowing Over Them

According to the Reynolds theory of heat transmission the heat transmitted from a hot surface to a fluid flowing over it for a given velocity of flow and difference of temperature is proportional to the frictional resistance between the fluid and the surface. Previous investigations at the laboratory and elsewhere have fully demonstrated the truth of this theory for the cases of commercially smooth surfaces, and owing to the considerable attention which is now being devoted to increasing the efficiency of radiation of air-cooled engines, it was considered to be of importance to determine whether the considerable increase in frictional resistance which would be obtained by artificially roughening the surface would be attended by a corresponding increase in the heat transmitted. The necessity for such an experimental investigation is apparent from the consideration that the Reynolds theory is based on the convection of heat due to turbulent motion, and that in cases in which the resistance is due to eddies on a larger scale, such as those thrown off from the edges of a thin plate normal to the current, its application may not be valid. A series of heat transmission experiments was accordingly undertaken with two brass pipes identical in all respects except that in one the internal surface was in the smooth drawn condition in which it was received and in the other the internal surface was roughened by means of a screw-cutting tool so as to form a series of sharp ridges. Water was circulated through the pipes by means of a centrifugal pump provided with suitable speed regulation so that the mean velocity of flow could be varied from 15 to 100 cms. per second. The outside of the pipe was surrounded by insulated coils of Eureka wire connected to the supply mains through variable resistance, and so arranged that the temperature of the pipe could be maintained at the desired value above the temperature of the water. The mean surface temperature of the pipe was measured by an extensometer specially designed for the purpose. For the estimation of the initial and final temperature of the water, thermojunctions in thin brass tubes were placed in the water at the extremities of the experimental length and connected to a potentiometer. The estimation of the flow of water through the pipes was obtained from a carefully calibrated meter. Observations of the frictional resistance of the pipes were made by the usual method. The investigation is not yet completed, but sufficient evidence has been obtained to demonstrate that for the degree of roughness of the pipe used the Reynolds theory can be applied for all practical purposes.

Equipment

The new wind channels, 4 and 7 ft. in diameter respectively, which were reported to be almost complete at the close of the last annual period, have been in continuous use for almost the whole of the current year. In both it has been found possible to obtain air speeds of 80 ft. per second with the more powerful motors installed, and the steadiness of the current is quite satisfactory when the supply is steady. In the early months difficulties were experienced from very sudden changes in the frequency of the supply voltage to the laboratory, which caused much inconvenience. The steadiness has since been greatly improved by the supply company, and the electrical plant rendered suitable for accurate work by careful attention to the voltage regulator installed in the generator room of the division. In the evenings the control so obtained is sufficient to render unnecessary continuous hand regulation of the air speed during an experiment.

The channels and balances of the new equipment were carefully set up independently of results obtained in the older channels. The speed standard was, as before, the standard National Physical Laboratory anemometer calibrated on the whirling arm to the nearest 0.1 per cent of velocity. After setting up in this way, a standard wing section was tested, and the results were found to agree with those in the earlier channels. The same accuracy of agreement was found in a comparison made by the Massachusetts Institute of Technology and by the Royal Aircraft Factory, who followed National Physical Laboratory methods. The absolute accuracy of the methods appears to be established as of a high order.

New methods of test have been developed during the year in order to deal with new requests; the difficulty of the experiments called for is steadily increasing, and greater complexity in the models has made it important to consider new methods of holding them, so as to get the necessary mechanical strength without undue aerodynamical effects, which may be large unless the utmost caution is observed.

It is believed that the new methods have now been established beyond the experimental stage, and will form part of the accumulated experience of the division.

Experiments on Airship Models

Much work on the resistance and stability of airships has been carried out during the year, both on the non-rigid and rigid types. The results when applied in practice have proved to be very valuable, having led to the economy of time which follows from the success of the first attempt.

Work on screens for the shielding of airships has also received considerable attention. The structure of eddies is very complex, but methods have been devised whereby the necessary observations and records can be made. The more advanced results of the investigation are now becoming available and will shortly reach the stage at which a report can be made on the motion of the air in the neighborhood of an airship shed and screen.

Further investigations have been carried out on the equilibrium of kite balloons in direct connection with their use on the full scale, and modifications have been indicated which are now commonly adopted.

Experiments on Models of Aeroplane Wings

The work on aerofoils has covered the usual field, which includes work on new sections, the effect of combinations of planes and, in particular during this year, the aerodynamic properties of triplanes. Deformations of wing form due to the sagging of the fabric have been reproduced on a model and the variation of wing characteristics dependent on such deformations has been determined.

Experiments on Complete Models of Aeroplanes and Seaplanes

The results in the 7 ft. channels have proved that the increased scale and speeds made available do not lead to appreciably different results from those obtained in the smaller channels. The advantages of a larger section of channel are considerable in dealing with complete model aeroplanes as the mechanical accuracy of construction can be carried to further length.

The number of tests on complete models has again been considerable, and recently two very accurate and complete models have been constructed, one at the National Physical Laboratory, and the other at the Royal Aircraft Factory, on which work will continue for comparison with full scale observation of stability and performance.

The results so obtained are also useful for the calculation of the motion of an aeroplane when maneuvering or when looping, conditions in which the aerodynamical conditions react directly on the stress problems connected with aeronautics. General methods of dealing with the strengths of aeroplanes and propellers come up for consideration from time to time and where necessary the calculations are supplemented by additional experiments directed towards the determination of the forces acting. The conditions of flight are continually changing and are accompanied by fresh problems requiring solution.

Test on Aeroplane Bodies

The experiments under this head refer more particularly to the body as forming part of the whole aeroplane structure. The conditions of shape are fixed partly by aerodynamical considerations but on the whole more by the size of engine employed. The increase of resistance of the body due to the slip stream from the propeller is important, and for both pusher and tractor types has been made the subject of direct experiment.

Stability

In this section very little new ground has been broken, but the applications and detailed analysis have received much attention. Some work has been carried out on the stability of kites and kite balloons in addition to that of airships which has already been referred to.

Propellers

A number of propellers have been tested during the year, mostly in a wind channel, but occasionally on the whirling arm. The subject of the airflow round a propeller has been investigated from the point of view of design, and the investigation has led to an addition to the theory of design which is expected to ensure greater certainty in producing a propeller which is suitable for a special purpose. The work has given an explanation of a large part of the empirical design factors which have been used in the past. The theory in its new form has a direct bearing on the problem of the helicopter, and shows reason for large errors in applying the older methods of calculation to the problem of direct lift.

Special Investigations

During the year an analysis has been made of the performance of aeroplanes as measured by tests on the full scale. The conclusions reached are of very direct practical application, and it is hoped that they will lead to improved performance by directing attention to the salient features of importance in the design of a modern aeroplane.

Calculations have been made of the trajectories of aerial bombs, and the experiments on radiators have been continued.

Alloys Research

To a large extent, the work on aluminum alloys, which has been carried on throughout the year with the greatest possible energy, has been devoted to the immediate practical requirements of aircraft construction. A very large amount of work has been carried out and a long list of reports on a number of points of first-rate importance has been submitted, in the first place to the Advisory Committee on Aeronautics and to the various Admiralty and Army authorities concerned with aircraft construction. More recently the Advisory Committee on Aeronautics has formed a sub-committee to deal with light alloys, and on this sub-committee the laboratory is represented by the superintendent of this department. The work of this sub-committee is already making itself felt in a considerable increase in the amount and urgency of the work required of the department in connection with light alloys. At the same time it is gratifying to find that a considerable number of these results, thanks to the activity of the sub-committee and the representatives of the Air Board upon it, are finding immediate translation into practice. The work of the department in this connection may, therefore, reasonably claim to have assisted to a material extent in the development of the very marked improvements, particularly in aeronautical engines, which have been achieved during recent months.

During the year there has also been a marked revival in connection with those aspects of work on light alloys which have been carried on under the auspices of the Alloys Research Committee of the Institution of Mechanical Engineers. Much of this work overlaps and interlocks with the work required for immediate aircraft purposes, but, thanks to the grants from the Alloys Research Committee of the Institution of Mechanical Engineers, and, through them, from the Industrial Research Department, it has been possible to investigate a number of matters of broad and fundamental interest in connection with the whole question of aluminum alloys and their future use and development.

Three training machines starting on a squadron flight at a U. S. Army Field

FORMATION FLYING

By F. W. LANCHESTER

The apparition of a German air squadron flying in formation over London, in the air raid of July 7th, has been the means of exciting considerable public interest in the question of formation flying and all that it means. In the present and sequent articles I propose to discuss its objects, its advantages, and its difficulties from all points of view.

Formation flying, in brief, means that an air squadron or combined air squadrons, instead of flying as individual aeroplanes, each bent on the object in view but under separate command, fly in a definite prearranged formation or pattern, in which, in naval phraseology, the machines have orders to "keep station." Formation flying broadly is not new. It is older than history. Many birds when flying in company habitually fly in formation. There is a marked difference, for example, between the manner of flights of rooks, which habitually fly in company, and that of wild geese; the wild goose or wild duck may often be seen flying in formation. The formation familiar to those who have studied or observed the flight of birds in nature is that of a V (Fig. 1), in which the direction of motion is apex foremost, the leading bird being common to the two limbs of the V. The number of birds flying together may vary, and the number in the two limbs of the V may not be the same, but the general character of the formation is always maintained. It has been noticed by many observers that the leader will be changed from time to time; the bird leading at one time will drop back and another will take its place.

In the early days of the war we heard little or nothing of formation flying; in fact, it is only during the last twelve months that the practice has become common, and in certain directions general. Nowadays we often hear that formations of our own machines and those of the enemy have met in combat. However, in a series of articles written soon after the outbreak of war,[*] the writer discussed the question of formation flying at length, and dealt with many of its advantages. Before passing to the more detailed discussion of the subject it is necessary to give some brief recapitulation of the arguments used and the suggestions made in the articles in question. At the outset it may be well to point out that but little doubt exists today that the adoption of formation flying amongst birds is consequent on the fact that it leads to economy in power; in other words, that flying in V formation saves labor on the part of the bird, enabling it to get over the ground with less work. It is to be remarked in this connection that formation flying is mainly confined to birds of considerable flight speed, corresponding to the condition of heavy loading; that is to say, the birds which fly in formation are commonly those in which the supporting area, and particularly the wing span, is small in proportion to the weight of the bird.

Undoubtedly formation flying is of value for the same reason when the aeroplane is concerned, i. e., economy of power, but this is not the only advantage, and it is not by any means the greatest advantage in military aeronautics. Military necessity requires that each ultimate unit or "atom" of any force shall be combined with its fellows in such a manner as to impart the greatest fighting value to the force as a whole. Thus a mob consists, if we may say so, of a number of "atoms," the individual man being the indivisible unit, and the power of such a mob may be represented at the best as the sum of its units. Let the same mob be trained and drilled into an army, and its power as a fighting force is multiplied many, many times. In the air the single machine or aeroplane is the "atom," and a concourse of machines flying without formation, even though acting for a definite purpose, is little more than a mob when it comes to aerial combat. The first step in increasing or enhancing the fighting value of such a force is to organize it as larger units, i. e., flights and squadrons—ultimately perhaps fleets—which are trained and commanded to act collectively.

Fig. 1.

The mob or concourse loses power as compared with an organized force in two different respects, firstly, although its members may be all actuated by the same motive, they do not act in unison, and the pressure of one individual is applied at a different instant of time to the pressure of another, and so the total effect is often less than that of the sum. As an illustration it is well known by drivers of teams of horses that without special training it is disadvantageous to employ more than six horses or thereabouts in a single team, because when that number is exceeded the aggregate pull no longer increases with the number of horses, the conditions approximate to those of a mob: a greater number of horses cannot be relied upon to pull together.

The second reason is that in organized military effort the effect of numbers is greater than the sum of their individual efforts, the extent of the increase depending upon the conditions of warfare and methods employed.

The greatly enhanced value of organized numbers is one which has been known and exemplified in military history time after time. The fact that where fighting is concerned, numbers count in greater relation than their numerical value has been the basis of the strategy of many of the great victories won by Napoleon and the generals of the eighteenth century; thus, were there no value in numbers beyond their arithmetical sum, it would be of no signal advantage to combine two forces before attacking an enemy, nor would it give any overwhelming advantage to fall upon an enemy in detail before he had time to effect a combination.

In two articles to "Engineering," dated October 2d and October 9th, 1914,[*] an analysis is given showing that under certain well-defined conditions which may be taken as typical of open warfare, whether at sea, on land, or in the air, the value of a force is proportional to the square of its number. This is now well known as the "N-Square Law." Concerning this law, Major-General Sir David Henderson, in a Preface to "Aircraft in War," wrote:

"There are two theories, however, evolved by Mr. Lanchester, to which I may safely draw attention. The first he has called the 'N-Square Law,' and it is, to my mind, a most valuable contribution to the art of war. It is the scientific statement of a truth which, although but dimly perceived, has been skillfully used by many great captains, both Naval and Military, but it is now for the first time stated in figures and logically proved. War cannever be governed by the rules of exact science; there are too many conflicting factors, too many fortuitous circumstances; but there are certain rules, whether based on experience or calculation, which no commander may lightly transgress. Concentration of force is one of these rules, and a statement of the inevitable disadvantages of dispersion is valuable. The examples chosen from sea and land warfare illustrate the working of the law with admirable precision."

The examples of the working of the "N-Square Law" in military history cited in "Aircraft in Warfare," and referred to in the passage quoted from the Preface by General Sir David Henderson, were the defeat by Napoleon in his Italian campaign of the Austrians near Verona, where he dealt with the two Austrian armies in detail before they had been able to effect a junction; and, secondly, the equally celebrated case of the defeat of Jourdan and Moreaux on the Danube by the Archduke Charles in 1796. The Battle of Blenheim, 1704, may be quoted as a further illustration.

In naval warfare the tactical scheme of Rodney in the Battle of the Saints in 1782 was cited; also Nelson at Trafalgar in 1805.[†]

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[*] "Engineering," November 20th and December 4th, 1914.

[*] Republished "Aircraft in Warfare," Constable and Co., Chaps. V. and VI.

[†] Compare "Aircraft in Warfare," pp. 62 et seq.

(*Continued on next page*)

A REVERSIBLE TYPE OF PROPELLER

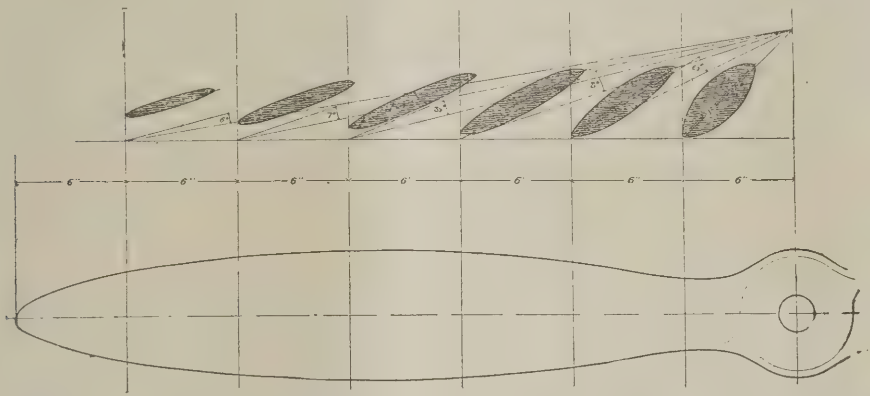
Although the theory of propeller design is not yet thoroughly understood, such theories as exist being in many cases contradictory, the general trend may be said to be towards an appreciation of the theory first advanced by Drzewiecki in 1882, and which was to the effect that each element of the screw blade may be considered separately and as behaving in the same manner as if moving through the fluid in a straight line. Applied to the air screw this means of course that the elements along the blades are treated as aerofoils, and that the sections which have been found to give good results in large size as wings of an aeroplane will, generally speaking, be found to give good results on a reduced scale when forming the elements of an air screw. The general characteristics of lift coefficients, drift coefficients and lift drift ratios are applicable to the elements of the screw—modified, of course, to suit constructional considerations.

For a considerable time now, Mr. A. Austin, of Kempston, Bedford, has been experimenting with air screws of various shapes, all having one characteristic in common, however they differ in details—i. e. they are reversible. In the accompanying illustrations are shown two of these propellers, one of which has a radially expanding pitch in which the chord lines of the various elements are sensibly parallel at all radii. In the other propeller it will be seen, a more orthodox method has been followed, in that the helix angles diminish in the manner usual in a propeller of uniform pitch, while the angles of a tack do not vary greatly from root to tip.

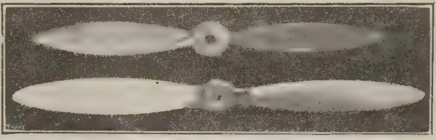
What is most interesting about these propellers, however, is the fact that they are reversible, and that therefore the sections at various radii from the center of the propeller boss are totally different from those generally used in air screws.

The peculiarity may, perhaps, be best explained by saying that the blades consist of the upper surfaces of an ordinary propeller turned round end to end and with their flat under surfaces together. It is, of course, not to be understood that this simile refers to the construction, which is of the usual laminated type, but merely to the sections. These latter, by the way, are not to be taken as absolutely correct, as Mr Austin did not supply us with drawings, and so, in order to get a clear idea of the principle of the propellers it was necessary to find the angles and sections by placing the propellers on a table, the angles being measured and the projected blade widths found, while the sections were obtained by making templates in plasticine at various radii from the boss.

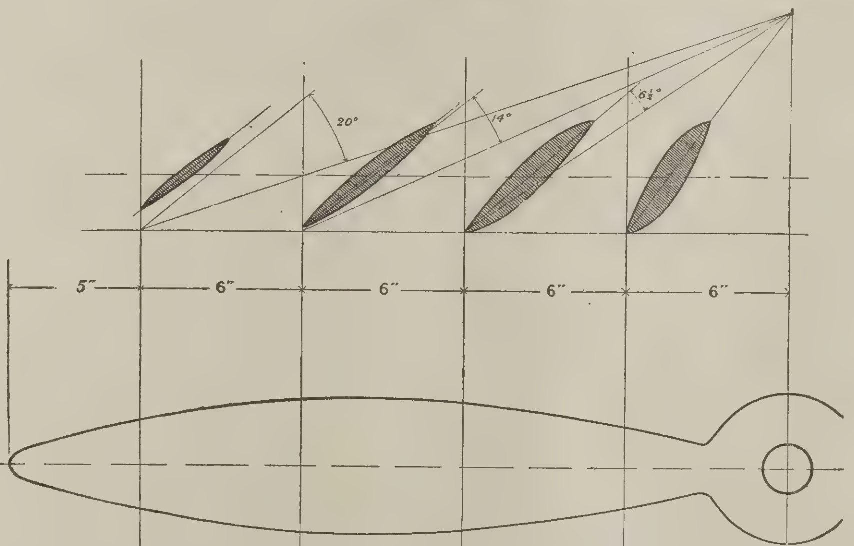
With regard to the sections the drawing shows with sufficient accuracy the general peculiarities, which are that for the top camber the maximum ordinate is situated from about half way to quarter of the chord from the leading edge, while in the lower surface the position is reversed, the maximum ordinate being situated from one-half to one-quarter from the *training edge.* Whether this section would be very efficient considered as an aerofoil is impossible to say until results of model tests are available, but a fair idea may, perhaps, be formed by comparing them with *Aile* No. 56, tested at the Eiffel laboratory. This section, which was tested for the Deperdussin firm, shows very similar characteristics, except that it has a considerably higher fineness ratio. The Deperdussin section has, according to Eiffel's tests, a maximum lift coefficient of O.36 (Absolute) at an angle of incidence of 15° while at the more usual angle for a propeller blade, i. e. about 6°, the lift coefficient O.16. These values are not very high compared with other aerofoil sections, and it would be interesting to see whether the section would prove more efficient on a screw. The lift drag ratio of the Deperdussin section mentioned above is about 7'7 at an angle of incidence of 6°, which is not encouraging.



Another form of reversible propeller, in which the pitch may be said to be uniform, but the angles of attack vary.



Two of Mr. Austin's reversible propellers.



Reversible propeller with radically expanding pitch.

(Continued from opposite page)

It is on the basis of the "N-Square Law" and its applicability to air-fighting that the main argument was advanced in "Aircraft in Warfare" for flying in formation. The "N-Square Law" means briefly that if, for example, only five machines were flying in sufficiently close formation to act in attack or defence simultaneously—that is to say, so that no enemy could approach one without coming under fire of all—they (in formation) would be more than a match for any force of machines (of equal individual fighting value) that might attack singly up to the number of twenty-five. In practice, the law, as in all human affairs, can only be regarded as a broad indication of the position, as remarked by General Sir David Henderson in the passage quoted: "There are too many conflicting factors, too many fortuitous circumstances." In the case in point doubtless an individual machine could attack a formation of five without coming equally under the fire of the whole formation; beyond this the single machine has a freedom of maneuver which a formation has not, and could never have. However, these facts can only modify and never destroy the advantage derived from concentration, and in the future of air warfare formations must be met by formations, just as in naval warfare cruiser squadron meets cruiser squadron or battle fleet battle fleet, and victory is to the strong.

Range of Effective Fire

But there are many other points which require discussion in connection with formation flying than the generalities which have so far been put forward. The subject is full of fascinating problems, both interesting to the scientific man and to the student of the art of war; the practice of formation flying is without doubt in its infancy, it is scarcely yet as far advanced as anticipated by the study of the problem (and the forecast given) in "Aerial Flight," to which reference has been made. The size of the formations engaged in aerial combat will in future depend very greatly upon the weapons and the range which it is found practicable to employ when aeroplane attacks aeroplane. At present this is comparatively short, many pilots reserve their fire until within 200 yards or less. So long as short range work alone is regarded as effective, so long shall we see the numerical strength of the formations which can be usefully employed limited, but as the science and art of air gunnery advances, with improved weapons and better methods, and greater skill in sighting, the size of formation which may be advantageously employed will become greater and the number of machines embodied in a unit formation will become larger. Simultaneously, and hand in hand with the above, improved methods of signalling will be needed in order that unity of command may be preserved.

From the present aspect the following passages may be quoted from "Aircraft in Warfare"*

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* Pp. 138, 139 and 140.

(*Continued on page* 831)

THE BURGESS SPEED SCOUT SEAPLANE

ONE of the neatest scout machines of American manufacture is the Burgess HT-2 seaplane, probably the only machine of the speed scout class that has met the requirements of the Navy Department for hydroaeroplanes. The Burgess Company's experimental works has developed and perfected a number of original construction features in this scout, the most apparent of which are the struts between the planes and to the floats, the shock-absorbing float system, and a detailed elimination of sharp angles by means of balsa-wood streamlining.

Tests of the seaplane were made by W. E. Doherty in numerous flights this summer to discover places where the slightest improvements could be made in the original design. These changes noted on the accompanying line drawing, show vertical surfaces between the front and rear overhang masts; the elimination of brace wires on the ailerons; the cutting away of the upper plane aft of the rear spar above the pilot; a slight difference in depth from the body to the tail float, and the balsa streamlining.

General Specifications

Wing span, upper	34′ 4″
Wing span, lower	21′ 6″
Wing chord, both planes	3′ 6″
Gap between planes	4′ 0″
Height over all	10′ 0″
Length over all	22′ 3″
Motor, Curtiss OXX-2	100 H.P.
Maximum speed	95 m.p.h.
Landing speed	50 m.p.h.

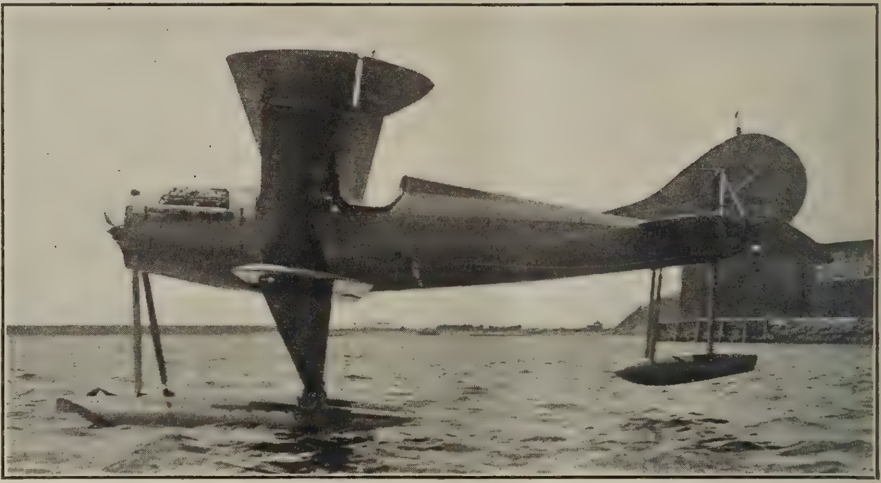
Planes

There is no dihedral, stagger or sweepback. The upper plane is in four sections, the central sections joined by a pair of metal plates at the wing spars. Each section 11′ 0″ long. Outer or overhanging sections, to which the ailerons are attached, are each 5′ 10″ long.

The lower plane sections extend 9′ 4″ at either side of the fuselage, which is 30″ wide at this point. Ribs are spaced 9″ apart. The forward main spar is centered 8″ from leading edge; spars centered 20″ apart; and the trailing edge is 14″ from the center of rear spar. This totals to 42″, the chord of the plane.

Internal drift wires are terminaled to the ends of tapered compression struts, the ribs being relieved of this strain. Overhang brace wires and interplane brace wires are doubled, and the space between filled with spruce streamlining strips, the edges of which are routed out to receive the wires.

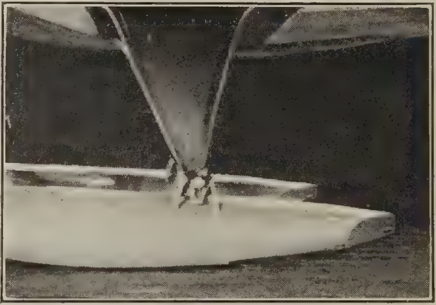
The struts are K shaped, built up of spruce and covered with fabric. In forming the strut, one spruce member runs from below the upper rear wing spar to top of lower forward wing spar; another member runs from below upper forward spar to lower rear spar. This forms an X. A third member between the upper and lower forward spars gives the K shape. The ends are filled in to a curve with balsa-wood, doing away with the angles, and producing a streamline effect.



Side view of the Burgess HT-2 speed scout seaplane.

Body

The forward part is covered with louvred sheet aluminum in the usual manner. The circular radiator at the nose is 27″ in diameter. The sides and top of the body are curved beyond the longerons by means of thin horizontal strips of spruce, supported on formers, and covered with fabric. The top is provided with a semi-elliptical streamlining ridge starting at the pilot's head-rest. The top of the body is in sections, which are separately removable.



The shock-absorbing float support.

The pilot's cockpit is exceptionally deep and roomy. Deperdussin control is installed; the aileron control passes through the sides of the body at a point 12 inches above the lower plane, on line with the forward edge of struts, running to the top of the K strut, thence to a pulley attached to the underside of the upper wing spar, and then to the aileron crank. Control wire openings in the body are protected by heavy skin washers, sewed to the fabric.

The cockpit top, above the instruments, is formed with celluloid, giving ample lighting to the cockpit interior and at the same time providing a satisfactory wind shield.

Tail Group

The rear spar of the tail plane is 11′ 0″ long. Solid wire braces run from both the forward and rear spars to the top rear end of the vertical fin, and also from underneath the forward spar to the tail float.

The root of the vertical fin is built into the curved fuselage top. The rudder has a small balancing surface forward of the hinges, the lines of the rudder continuing from the curve of the fin.

The pair of stabilizers are attached to a single forward spar, causing them to work in unison. Control crank arms are 9″ high, with a pair of solid brace wires to each.

Floats

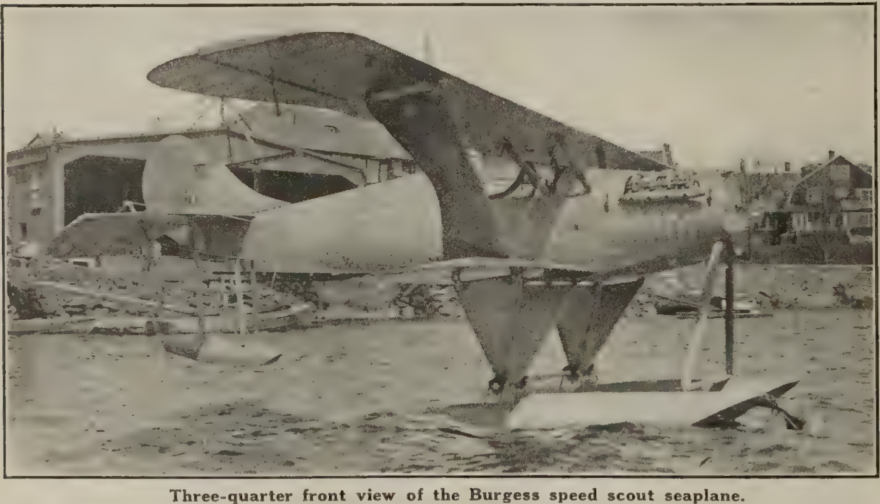
Main floats are 11′ 0″ long, 3′ 0″ wide and 17″ in maximum depth. They are spaced 6′ 6″ from center to center. The forward horizontal strut between the floats is located 2′ 2″ from the bow, and the rear strut, which acts as a shock-absorbing axle, 7′ 2″ from the bow. Struts run from the forward horizontal strut to points near the radiator. The rear axle is at the lower termination of the V struts, which run from the fuselage and the lower plane, continued in the K strut to the top plane. This axle is attached to the float by rubber cord, with metal guides to allow for the vertical movement of the axle. By means of this system of shock absorbing, much of the porpoising has been eliminated when taxi-ing, and many of the hard landings are entirely taken up by it.

Hand holds are provided at each compartment, screwed flush with the deck. Mooring rings are attached at the forward end of each float. A step occurs just below the rear axle with a 2″ air duct run through the float to prevent suction.

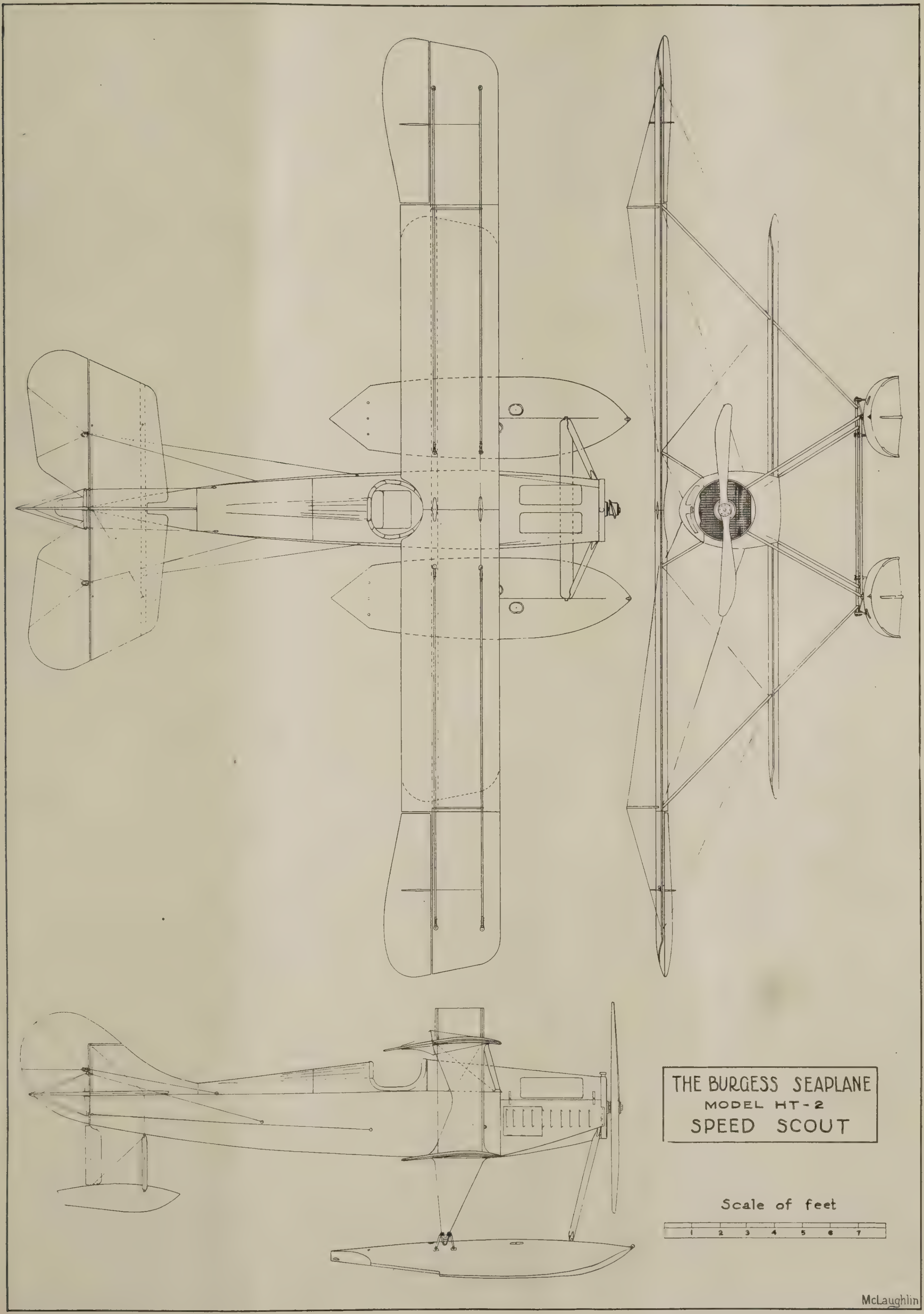
The main support for the tail float is provided in a 26″ extension of the fuselage termination which is streamlined fore and aft, to a width of 7½″. A pair of struts 24″ long are located 15″ from the front of tail float, and bracing wires run from their upper ends to the lower end of rear strut. Overall length of pontoon, 4′ 6″, width 11½″, depth 12″.

Motor Group

The propeller, designed by the Burgess Company especially for the speed scout, is 7′ 9″ in diameter, with a 5′ 9″ pitch. The motor is a Curtiss OXX-2 rated 100 H.P. at 1,400 r.p.m. Fuel is carried for a flight of 2½ hours' duration.



Three-quarter front view of the Burgess speed scout seaplane.


THE BURGESS SEAPLANE
MODEL HT-2
SPEED SCOUT
Scale of feet
1 2 3 4 5 6 7
McLaughlin

THE SPEED OF AEROPLANES AT HIGH ALTITUDES

By HARLAN D. FOWLER, Aeronautical Engineer

SINCE the European war broke out the requirement for performances of the aeroplane has been revolutionized to such an extent that they will soon be divided into well defined groups or classes. At the present time there are signs of these groups being categoried. Among one of the most recent and important innovations necessitated by warfare conditions is the test for speeds at various altitudes.

The fact that the speed of an aeroplane always decreases with height has been known for some time. Until recent date the maufacturers had not given much attention to this matter, but efforts are now being put forth to keep the speed as stationary as possible at all heights. Claims have already been made that the aeroplane speed has actually been made to increase with this increase of altitude.

The factors to be considered in the matter of keeping the speed stationary, or to accelerate it, are (1) the total resistance of the aeroplane at all angles of incidence; (2) the pitch, and consequently the thrust, of the propeller; (3) the revolutions of the motor, which is regulated by the actions of the carburetor to a great extent.

Atmospheric Conditions.

Before going deeper into this study we must first understand the actions of the atmosphere. At sea-level the atmosphere has a pressure of 14.7 lbs. per sq. in. at 60° F. This is caused by the weight of the air, which incloses the earth to a depth estimated by meteorologists to be about 100 miles. At this height no human life can exist without some special device for counteracting the ill affecting influences which would be encountered, and it is doubtful whether any contrivance can be made to go so high. The higher one goes the less the depth of atmosphere above, and therefore the less the pressure and density. Fig. 1 will make this clear. At 20,000 feet the density is very nearly half that at sea-level. A serious defect exists, however, when the temperature is taken into consideration. In Fig. 1 the pressure and density at sea-level are for a temperature of 62° F. If the temperature is higher than this the air is lighter, and the pressure at sea-level less. No matter what the temperature is at sea-level it always drops with altitude, except in rare instances when it might rise a few degrees but it will finally go down. For example, if the temperature at sea-level is 75° F. it will probably be near —75° F. And upon investigation it will be found that due to this variation all recording instruments do not register truly, and that all the results will have to be corrected before applying them to mathematical computations.

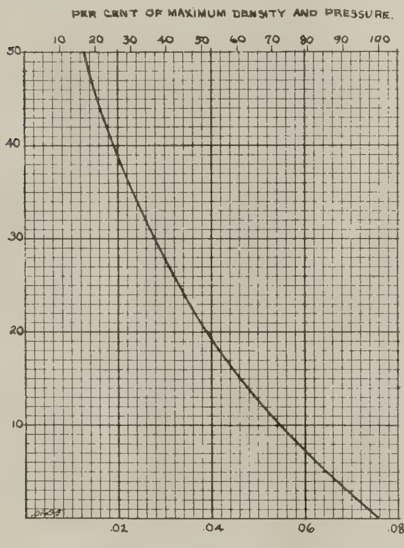


Figure 1

The resistance of the aeroplane will decrease with the height for the same speed, but in order to sustain itself at similar angles of incidence the speed must increase.

In order to keep up this speed the pitch, and therefore the thrust, of the propeller must be such that it will transmit the required power.

The carburetor is very much affected by the heat factor. The colder the atmosphere the more collected becomes the gas fumes, and poor ignition takes place. Working in conjunction with the temperature is the decrease of density of the air which causes improper mixture between the air and gas drawn into the cylinders. The result is a decrease in the efficiency of the carburetor and the attending loss of power, which regulates the revolutions accordingly.

From tests recently carried out in England the loss of speed and revolutions has been determined approximately accurate. Allowances were made for temperature and density and the final results properly corrected. Fig. 2 shows two curves which are averages taken from the results of two of the above tests and indicates the percentage loss of speed and revolutions from their maximum efficiency at 3,000 feet. As 3,000 feet was chosen as their standard height we will assume that the maximum efficiency of the speed and revolutions varies little from those at sea-level and that height. However, for calculating the power required we will work from Fig. 1 and from Fig. 2 for the effective power available. The discrepancy will be slight. The curves in Fig. 2 are for a temperature of 39° F. at 3,000 feet and until further trials are made there is no way of determining exactly the losses due to the difference in temperature of 39° and 62°. The per cent decrease of density in Fig. 1 will hold good for any temperature at sea-level.

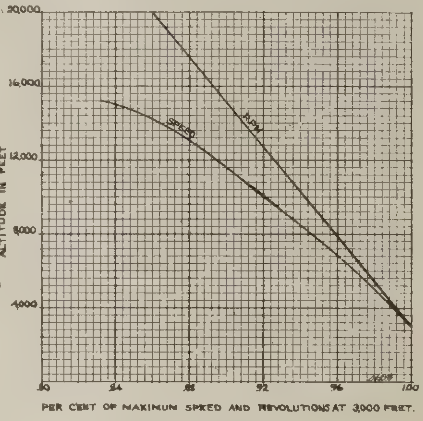


Figure 2

The Variation of Speed and Horsepower Required with Height.

The required speed and power varies as the square root of the percentage decrease of the density, that is, for an altitude of 15,000 feet the density of the atmosphere is 61% of the density at sea-level. By dividing the speed and power required for flight near the ground by $\sqrt{.61}$, or .78, we will have the speed and power required to sustain the aeroplane at any particular angle of incidence. This is proven by the following example:

For a weight of 2,500 lbs. complete and 500 sq. ft. wing area, for which all further calculations are made, there is a lift coefficient of .00044 lb. per sq. ft. per mile. At 15,000 feet the density is 61% of standard density. The speed at ground level is 106.6 miles per hour. The speed at 15,000 feet is:

$$V=\sqrt{\frac{W}{Ky \times A}}=\sqrt{\frac{2,500}{(.61 \times .00044)\ 500}}=136$$

m.p.h.

$$\frac{106.6}{136.0} = .78 \text{ which is the square root of } .61.$$

By the same reasoning the horsepower required varies in similar proportion.

Letting V = speed in miles per hour at sea-level; Vh = speed in miles per hour at a specified height; H. P. = horsepower required at sea-level; H.P.h = horsepower required at a specified height; d = percentage density at specified height; we have the following formulas:

$$Vh = \frac{V}{\sqrt{d}} \qquad (1)$$

$$HPh = \frac{HP}{\sqrt{d}} \qquad (2)$$

Predicting Performances.

In table 1, columns 2 and 4, are the actual speed and power required at 3,000 feet at various angles of incidence. As 15,000 feet was the greatest corrected height to which the British tests were carried we will calculate for speed at that height. Flying at this height is of common occurence in the war zone and for the time being appears to be an appropriate position, especially for aerial warfare; although 18,000 and 20,000 feet have been accomplished frequently. Columns 3 and 5 are the corrected values of speed and H.P. required for an altitude of 15,000 feet obtained through formulas 1 and 2. The results in Table 1 are indicated in Fig. 3.

TABLE I.

Angle of Incidence	Speed 3000 ft.	Speed 15,000 ft.	Power 3,000 ft.	Power 15,000 ft.
20°	44.0	56.4	128.5	165.0
18°	43.5	55.8	90.0	115.4
16°	44.8	57.6	75.4	96.6
14°	46.0	59.0	61.2	78.4
12°	48.2	61.9	53.0	68.0
10°	50.8	65.1	49.5	63.4
8°	54.4	70.0	48.2	62.0
6°	60.0	77.0	56.3	72.2
4°	68.7	88.1	71.8	92.0
3°	75.3	96.5	87.9	112.7
2°	82.8	106.1	112.4	157.0
1°	91.3	117.0	145.6	186.7

At 15,000 feet, developing 96 H.P. at 1300 R.P.M. Diameter of propeller = 8′ 9″, therefore, n = 18.83, d = 8.75, nd = 166.8

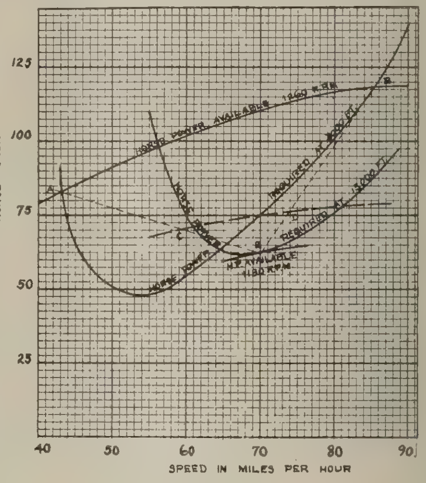


Figure 3

Fig. 4 is a typical horsepower chart. The

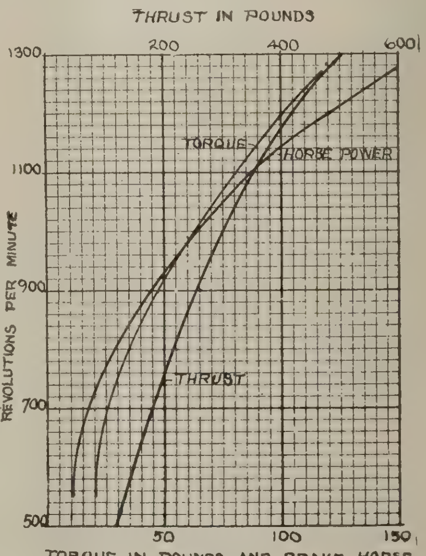
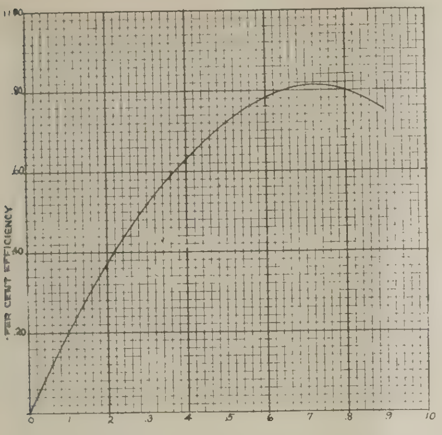


Figure 4



Values of $\frac{V}{nd,}$ D = 8 feet.

Figure 5

H.P. available at 3,000 feet has been estimated from the power chart, allowing for propeller efficiency which we will take up further on, and is represented by the flat curve AB. in Fig. 3. In Fig. 2 the r.p.m. has dropped off 90% at 15,000 feet which gives us 1260 x .90 = 1130 r.p.m. From the power chart at this number of revolutions the H. F. is 96.

Fig. 5 is a reproduction of one of M. Gustave Eiffel's propeller efficiency charts. V = forward velocity in feet per second; n = number of revolutions per second; and d = the diameter of propeller in feet. The propeller curve for efficiency gives 81% for the maximum which has been calculated to take place for a speed of 85 m.p.h. at 3,000 feet. But our curve for loss of speed at 15,000 feet indicates only 84% of the maximum efficiency at 3,000 feet. Therefore, the highest propeller efficiency to be expected will be 84% of .81 of 68% at 15,000 feet.

TABLE 2.

Speed M.P.H.	$\frac{V}{n\ d}$	Efficiency %	H.F. Available
45	39.5	52.1	50.0
55	48.1	58.8	56.5
65	56.9	63.0	60.5
75	65.6	67.2	64.5
85	74.4	68.0	65.3
95	83.2	65.5	62.9
105	92.0	58.8	56.5

Table 2 are the corrected values of propeller efficiency and H.P. available for various speed. The almost flat curve at E, Fig. 3, represents the values of H. P. given by this table. The junction of this curve with that of the H.P. required curve at 15,000 feet indicates that the aeroplane will reach this height at a speed of 70 m.p.h.

The maximum surplus power available for climbing at 3,000 feet is 47 H. P. at a speed of 55 m.p.h. This has dwindled down with the increase of altitude until at 15,000 feet no more power is available for climbing. The speed cannot increase and it must not decrease from the speed of the calculated 70 m. p.h. This loss in speed is 82% of the maximum speed at 85.5 m.p.h., which indicates a very close agreement with the speed loss predicted in Fig. 2.

An interesting phase is now presented by Fig. 3. By drawing the dotted lines AE and BE we are in a position to predict the speed range of the aeroplane at any height below 15,000 feet. Suppose we wish to know the speed range at 13,700 feet. From Fig. 2, the high speed at this height will be 86.5% of 85.5 m.p.h. or 74 m.p.h. The low speed may be found approximately by the following method: For the lower half of BE, *i.e.*, in our case below the 90 H.P. line, take the slope of the H.P. available at 1130 r.p.m. curve and lay it off at 74 m.p.h. on the dotted line BE at D, and the intersection of this sloping line on the dotted line AE, as at C, will give low speed. If the high speed is above the 90 H. P. line the slope of the curve AB should be taken. The number of revolutions represented by the line CD are 1260 x .912 = 1150 r.p.m. at 13,700 feet.

The matter of propeller thrust is also of importance. The total resistance of the aeroplane at 3,000 feet at 70 m.p.h. is 400 lbs. At 15,000 feet this is 61% less, according to Fig. 1, or 244 lbs. From the thrust curve we find that for 1130 r.p.m. the thrust is 370 lbs., and as the maximum efficiency to be expected at this height is 68% the propeller will deliver a thrust of 370 x .68 = 252 lbs. or 8 lbs. more than necessary, which surplus will probably increase the speed one or two miles per hour.

Sources for Improvements.

The source from which the curves in Fig. 2 were based did not state the conditions or adaptability of the motors and propellers on which a good deal depends the performances of the aeroplane. Since the curves do not indicate any stationary or increment of efficiency the motors and propellers may have been of the ordinary construction, *i. e.,* no special arrangements were made for flying at high altitude.

Some of the means available for practical solution present themselves from the results of the performances just completed.

The carburetor seems to be the most likely place for great development. The careful regulation of the heat factor would assist in making a better mixture of the air and gas. Auxiliary air ports with a proper flow of gas and pressure would also assist in keeping the pressure up and create a higher compression than would otherwise be had. By the proper adjustment of these two innovations, which are by no means new to the manufacturers, a considerable increase in revolutions and speed would result. If a motor could show this increase our performances curves would present a more promising aspect, such as the curve CD in Fig. 3 which we will assume represents the 1130 r.p.m. previously found for 15,000 feet. The high speed would be 81 m.p.h. and the low speed 61 m.p.h. with a surplus power of 15 H.P. available for further climbing with the result that the machine would be more efficient at a higher speed and greater altitude be had than would otherwise be obtained.

Another advance could be looked for from the variable pitch propeller. As certain altitudes are reached the pitch could be adjusted and thereby create more thrust with the subsequent increase in speed. Consideration would have to be made for the strength of the propeller when such alterations are permitted.

(*Continued from page* 827)

"Air Tactics: Formation Flying.—In order that the air fleet shall be brought into action as a single unit, it is not only necessary that it should be in its constitution homogeneous, as already pointed out, but it must also be handled in some definite formation. Where the numbers are moderate, as, for example, in the handling of a single squadron, the formation adopted may evidently be fairly elastic, and there will be no difficulty in bringing the tail of the formation promptly into action. When, however, as we may suppose will some day be the case, the numbers become great, the whole question cannot fail to become one of the first magnitude. The actual importance will again be greatly increased when air fleet meets air fleet, for in view of this eventuality, numbers will be augmented to an extent that we have as yet no means of gauging, perhaps beyond anything that we can at present imagine.

Types of Formations

"It would not serve any useful purpose in the present state of knowledge and development to attempt to discuss too closely the types of formation that may or may not be found suitable. We have the same, or an analogous, tactical problem in each of the older arms of the military organization, and in the Navy, and in every case, in spite of the store of practical experience available, there is still a deal of controversy, different ideas being represented by different 'schools' of thought; even in the case of the oldest arm of the Service—the infantry—there is no unanimity of opinion. This being so, it would clearly be futile to attempt to lay down any scheme for an arm which cannot yet be said to exist. However, in spite of all this, there are certain outstanding facts that cannot fail to have some bearing, and will assuredly act as controlling influences.

"Formation Flying: Airmanship and Signaling.—When the numbers become great a point will inevitably be reached when the accuracy and closeness of the formation will be a matter of first importance to the tactical scheme, since the only way in which the whole force can be brought to bear at once will be by a studied plan, in which each machine will have its allotted place. In other words, the number of machines from the point of view of the "N-Square Law" will no longer be the number brought into the field by the strategic plan, but rather such portion of it as can be brought to bear simultaneously on the enemy; it will become a battle of airmanship. One of the difficulties which exists today, and probably will always be a matter of anxiety, is that of signaling; and to whatever extent this remains a difficulty, the flexibility of the formation will be impaired. The air fleet with the most perfect system of signaling will be the best able to take advantage of any opportunity that may arise in the course of an engagement by adapting its tactical scheme to the needs of the moment. In order to render it possible to control large numbers, it would appear to be evident that the unit command will be a small group, or what is at present termed a 'flight' (some four or five strong), and that the individual machines will act on the plan of follow-my-leader; in other words, they will have instructions to keep station.

"The 'V' Formation and its Value.—There is a point in connection with the pattern or character of these unit formations which may turn out to be of importance. It has for long been observed that certain birds, flying numbers strong (as in migration), are in the habit of assuming definite formation, and that this formation is of the shape of a letter V, traveling point first; each bird, besides being some distance behind its leader, is also somewhat on one or the other flank. The reason for this is almost certainly one of aerodynamics; the air immediately in the wake of a bird in flight has residuary downward motion, and so is bad air from the point of view of the bird following. On the other hand, the air to the right and left of the leader has residuary upward motion, owing to the vortical character of the wake disturbance, and so is good air; consequently the V formation arises naturally from each bird seeking the air which gives the best support, a matter in which most birds show consummate skill. There is very little doubt but that, by this manner of flight (formation flying in fact), a flight of birds is able to cover the ground with a material saving of work done. If the point in question is as important as it appears, it will certainly have to be taken into consideration in connection with aeroplane tactics, and more particularly formation flying. The follow-my-leader formation will evidently be on a V or diagonal plan rather than in line ahead."

"Air Chasers" Need Best of Young Men

Paris.—"It will take the cream of American youth between the ages of eighteen and twenty-six to man America's thousands of aeroplanes. It will take the 'double cream' of youth to qualify as 'chasers.'"

This was the statement of Lieutenant Raoul Lufberry, American and premier airmen of the Lafayette Escadrille, today as he told the United Press of the qualifications America must seek in the men who are to act as the eyes of her armies in France.

Lufberry has been decorated with the Legion of Honor, the British Military Cross, the French Military Cross and the Cross of War.

"Experience has shown that for best results the fighting aviator should not be over twenty-six years old or under eighteen. The youth under eighteen is bold, but lacks judgment. Men over twenty-six are too cautious.

"Fighting 22,000 feet in the air produces a heavy strain on the heart. This organ showed not the slightest evidence of weakness. Eyeglasses are barred, sharpness of vision is imperative. Otherwise the enemy may escape, or the aviator himself will be surprised or mistake a friendly machine for a hostile craft.

"The ears must be able to stand air pressure. It is important to realize that so long as a man has skill in handling his machine and accuracy in fire he is never beyond hope. Americans from the ranks of sportsyouths who have played baseball, polo, football or have shot and participated in other sports will probably make the best chasers."

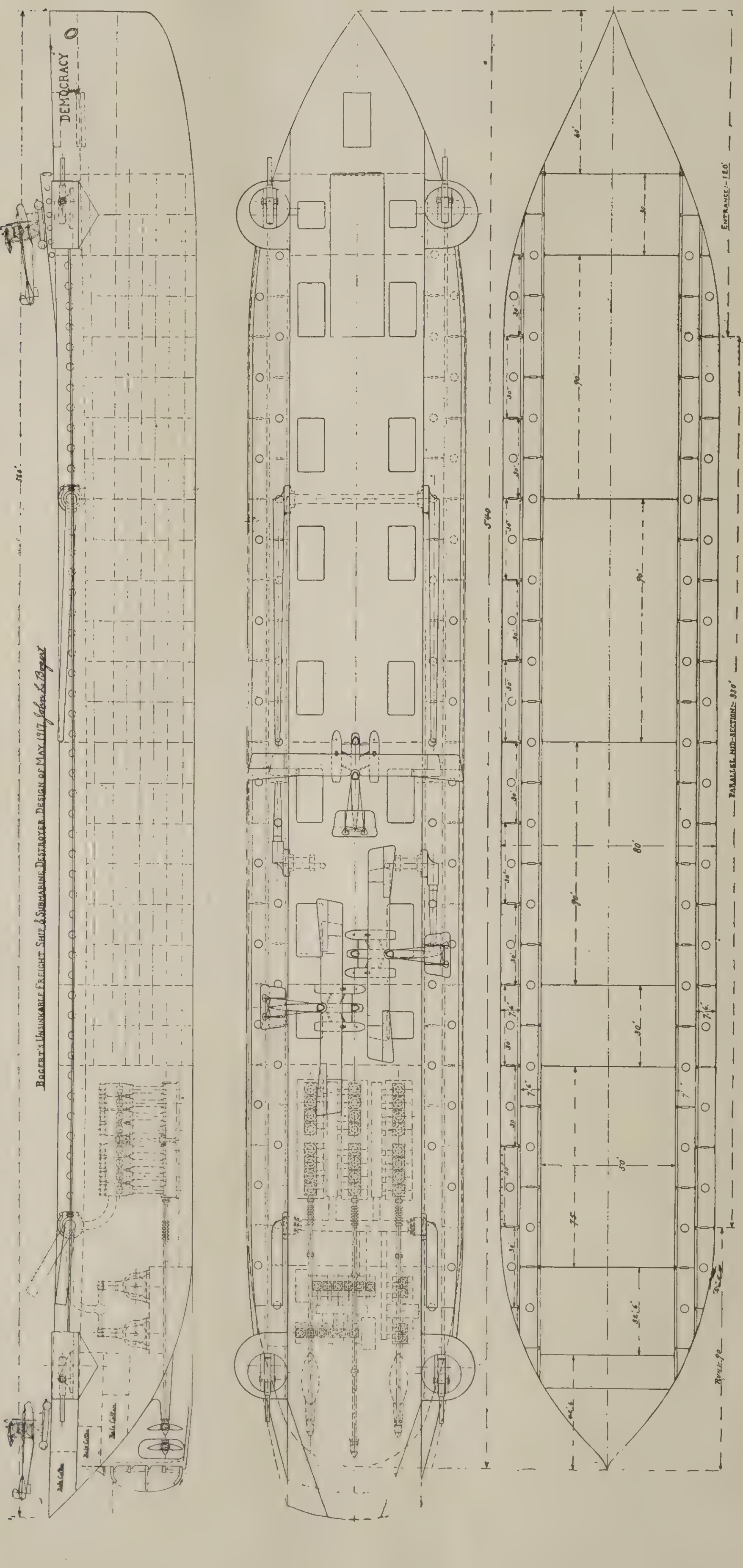
Mills Brothers Re-enter Aero Field

The Mills Brothers, James R. and George P. of Chicago, who in the early days of the aviation business for three years, ending 1913, conducted an aeroplane factory and an exhibition department in Chicago, manufacturing aeroplanes and booking aviators under the firm name and style of the Mills aviators, have decided to re-enter the aviation business for the purpose of manufacturing aeroplanes and have taken over the Hunt thrashing machine plant covering three city blocks, and have 120,000 square feet under roof fully equipped with wood and metal working machinery. Aviator Nels J. Nelson, who was formerly in their employ, is again permanently identified with the Mills.

Several well known aviators, such as Art Smith, Nels J. Nelson, Frank Stites, Victor Carlstrom, Alvin Wilson, piloted the machines manufactured by the Mills Brothers in 1911, 1912 and 1913.

AN UNSINKABLE MOTHER SHIP FOR AEROPLANES

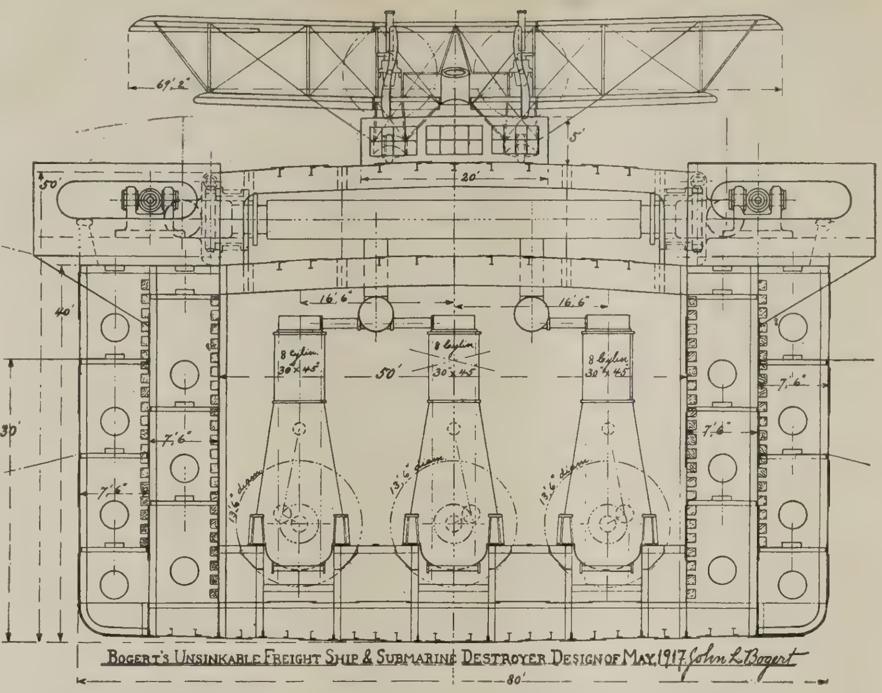
By JOHN L. BOGERT


DEMOCRACY
BOGERT'S UNSINKABLE FREIGHT SHIP & SUBMARINE DESTROYER DESIGN OF MAY 1917 John L. Bogert
540
ENTRANCE—120'
PARALLEL MID-SECTION—330'
RUN—90'
80'
50'

THE submarine has a deadly enemy—the aeroplane. For every poison there is an antidote seems to be a law of nature. The aeroplane can carry bombs capable of being set to explode either at contact with the water or so many feet under the water. The submarine under the water cannot see above the water, but the aeroplane, like a gigantic fish hawk, can and does see the shadow of the submarine many feet under the water, just as the bird sees the fish. The hawk swoops and dives to reappear with the fish; the aeroplane swoops to a short distance above the long dark cigar shape shadow in the water, and lets drop bomb after bomb. Lucky the U-boat that escapes. She must either go down so far that not the faintest indication shows up from below, or come up and fight with such anti-aircraft guns as she may be possessed of. But what chance has she if not one but several aeroplanes are circling over her, and if an unsinkable ship is but a short distance away with three 6-inch rapid firing rifles trained on the spot where she must emerge? The U-boat that elects to attack has no chance. Now the questions. If an aeroplane can spot and bomb a submarine, why don't they go out to sea every day on this kind of work? Answer: an aeroplane has but a limited carrying capacity, even when constructed of the largest size, with immense area of wings and great horse-power. When equipped with engines of nearly 300 h.p. the fuel consumption is some 30 gals. of gasoline per hour and the fuel tanks rarely carry more than five hours' fuel at full power. Then, too, machine guns must be carried. So, though the lifting power of the machine may be over 5,000 lbs., it can only fly while it has fuel, and must return for fresh supplies every few hours. If the aeroplane can fly at the rate of 80 miles per hour, and the U-boats are operating 200 miles out from the coast, all the aeroplane can do is go out, spend a short while looking round and then fly back. That is why the unsinkable "mother" ship is needed, some floating base of supplies, some sure landing stage and starting "take off." So a long vessel with a broad upper deck, free from all obstructions of any kind—no funnels, no masts, no cranes, no ordinary deck houses, no boats, no rafts, no wireless, no anything that might interfere with the alighting of the aeroplane or its launching. One of the original and clever features of this invention is the way in which these requirements are met. The boats, the cranes, the masts for signaling and wireless are all stowed below the upper deck, the masts and cranes being turned round horizontal thwartship axes by electric motors geared with worm and worm wheel gearing. The same is true of the smoke-stacks, funnels and exhaust-pipes. All ventilators project horizontally below the upper deck. The top of the pilot-house, for this ship can carry no navigator's bridge, is inclined aft, so that it makes an ideal "take off" for the departing aeroplane. The ship is not short—shortness would not be an advantage to the alighting or departing aeroplanes. As shown in the cut the overall length on the unobstructed upper deck is 560 ft. The upper deck is 50 ft. wide, and that is the width of the inner hull, but the cellular construction of the ship's sides bring the total width out to 80 ft. It is a question whether 74 ft. total width would not answer quite as well, which would mean a narrowing of the cells by 18". The essential point in this unsinkable construction is that no diaphragm, partition or bulkhead, whether longitudinal or transverse, horizontal or vertical, reaches from the inner hull to the outer skin. They extend from the outer skin to the mid-skin or intermediate skin, and from the inner skin to the mid-skin or intermediate skin, but never from the outer skin to the inner skin. The reason is that a torpedo exploding against the outer skin where a partition joins it would drive the partition inward and loosen its inner joints, so that they would no longer be watertight. The cut of a transverse section of the ship shows that longitudinal wooden stringers can be employed to catch the flying fragments of outer skin. Each cell then may be 30′ long, 7½′ wide and about 10′ deep. These cells are served by 3′ to 4′ man-holes, so that one might pass completely round the ship when in port and unloaded without coming out on the main deck. At sea all these man-holes are clamped watertight by their covers, and the flooding of one does not mean the flooding of any other provided the force of the explosion has not sheared the rivets and started the joints. Grain or coal might be the cargo carried in these sides. There is one point that has to be rather carefully considered. It is essential that the period of rolling for this vessel shall be as long and easy as possible, not stiff, short and jerky. Otherwise the upper deck would be an unsatisfactory landing stage. Ships without bilge keels whose beam is great in proportion to their depth have too great righting power when inclined, and their movements in waves are uneasy. There are two solutions of this problem: bilge keels and connected wing tanks with sufficient fluid shifting from starboard to port and from port to starboard to lengthen the period of roll. In the design and construction of these vessels all necessary precautions will be taken to keep the metacentric height within proper limits, and render the upper deck as stable a platform as possible.

The motive power shown is the Diesel engine, but that is by no means the probable source of power that will be used in this country. It is much more likely that steam in the shape of geared turbines or triple-expansion engines will be selected by the powers that be, because we have done so little with the large Diesel engine here, we have too few men skilled in their manufacture or handling. In Europe, especially in Denmark or Holland, no difficulty would be experienced in getting suitable four-cycle Diesel engines of ample power nor well trained men to run them.

Whatever the source of power, whether oli-engine or steam, the funnels, smoke-stacks or exhaust-pipes must make use of "dipping" mechanism similar to that indicated in the illustrations; it must be possible to lower them out of the way of the aeroplanes whenever the latter are alighting on the deck.



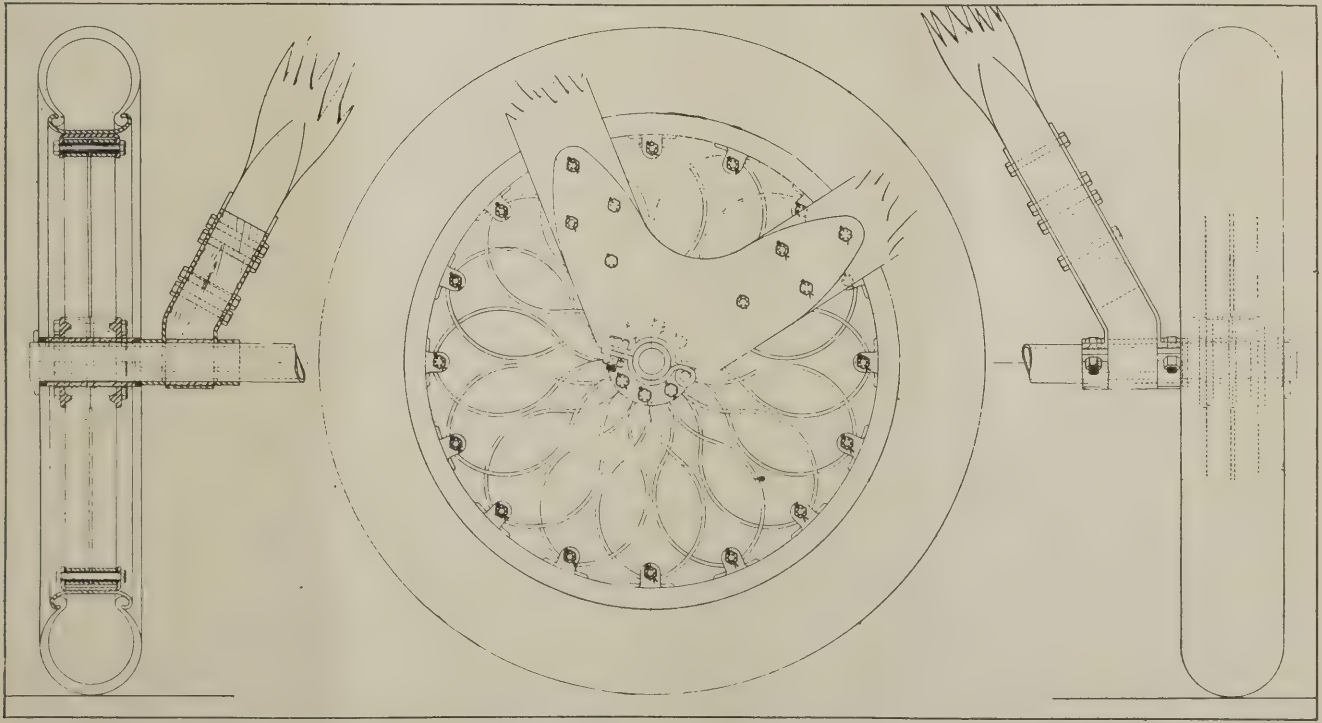
CHASSIS CONNECTION FOR ACKERMAN WHEELS

THE fact that the spokes of Ackerman wheels absorb all shocks in the landing of an aeroplane, has made possible the employment of an extremely simple connection between the axle and the wooden chassis V struts. The drawing shows what a neat and substantial fitting is used, doing away with the chance of mechanical failure as when the axle is bound on with rubber cord.

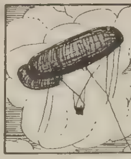
Such a connection is possible only where the axle is allowed to remain in a fixed position, and it follows that damaging landing-loads must be entirely absorbed before they are transmitted to the axle and thence to the fuselage. The single immovable axle eliminates the rigid cross-members which are necessary when a floating axle is employed, for in the Ackerman wheel the bracing is complete with merely the cross-member that also serves as the axle.

A pair of the wheels, with their axle, are readily detachable by removing a pair of bolts at the end of each chassis V. All bolts are locked with split pins and need no further attention for adjustment when once attached.

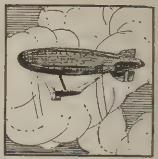
A further advantage is the presentation of minimum projected area and consequental dead head-resistance. The desirability of low head-resistance in the chassis, as well as unfailing resistance to breakage makes these wheels especially adaptable to scouts of high landing-speeds. The wheels are, however, made in sizes suitable for all types of aeroplanes from the light scout to the heavy battleplane.



Chassis connection of the Ackerman Aeroplane wheel to the axle



MILITARY AEROSTATICS



The Fort Omaha Balloon School

Mr. A. Leo Stevens, the veteran aeronaut and manufacturer of lighter-than-air craft, has been doing excellent work as Army Inspector in the operation of dirigibles, kite balloons and subaerial balloons at Fort Omaha.

Mr. Stevens' appointment was authorized by the Civil Service Commission December 1.

Mr. Stevens has had twenty-five years of experience in manufacturing and operating balloons and dirigibles, during which time he manufactured about 1,500 balloons of different kinds and made about 2,000 ascensions.

In joining the Army, Mr. Stevens gave up his factory and all private interests.

Mr. A. Leo Stevens' flights have ranked among the first in this country for a power-driven balloon as follows:

September 15, 1902, Manhattan Beach, N. Y., 8 minutes; September 16. 1902. Manhattan Beach, N. Y., 19 minutes; September 16, 1902, Manhattan Beach, N. Y., 40 minutes; September 24, 1902, Manhattan Beach, N. Y., 12 minutes; September 30, 1902, Manhattan Beach, N. Y., 41 minutes; October 1, 1902, Manhattan Beach, N. Y., 28 minutes; June 4, 1905, Manhattan Beach, N. Y., 16 minutes; June 14, 1905, Manhattan Beach, N. Y., 18 minutes; June 14, 1905, Manhattan Beach, N. Y., 36 minutes; July 4, 1905, Manhattan Beach, N. Y., 28 minutes; July 6, Manhattan Beach, N. Y., 20 minutes; July 9, 1905, with passenger, 16 minutes; July 9, 1905, 11 minutes; July 9, 1905, 27 minutes; July 25, 1905, with passenger, C. J. S. Miller, Franklin, Pa., 30 minutes; July 29, 1905, 14 minutes; August 6, 1906, 28 minutes; August 6, 1906, with passenger, Miller, 31 minutes; August 9, with passenger, Miller, 18 minutes; August 9, 1906, 21 minutes; August 10, 1906, with passenger, J. P. Thomas, 18 minutes; August 13, 1906, with passenger, Mrs. Mary P. Miller, night flight, 1 hour and 3 minutes; August 13, 1906, single flight, 30 minutes.

Has Contract for Additions at Fort Omaha

E. A. Wickham, of Council Bluffs, Ia., has returned from New York and Washington, bringing with him the signed contract with the United States for the erection of the hangars, barracks and other buildings at Fort Omaha.

Students in Night Balloon Trip

Following an all night trip in a balloon, eight United States Army men landed on a farm five miles south of Terre Haute, Ind., after a trip covering nearly two hundred and fifty miles. The party left the training camp at Merrillaie Park, near St. Louis, Mo.

The party was in charge of E. S. Cole, pilot. The other members were A. C. McKinley, J. M. Drescher, W. E. Mierman, M. W. Mears, H. D. Baird, J. A. McDevitt and C. W. Damman.

Airship Suspension Systems

The chief points to be borne in mind in designing the suspension system of an airship are:

One of the kite balloons at the Fort Omaha Balloon School

(1) The distribution of the weight over as wide an area of the envelope as possible.

(2) The reduction of head resistance.

(3) The reduction of overall height or head room.

And it is interesting to examine the various efforts which have been made to meet these requirements.

External Riggings Systems

In a spherical balloon the basket is slung from a net covering the top half of the balloon, and this method was adopted for slinging the car of most of the earlier types of airship from the Meusnier onwards. As, however, in a non-rigid or semi-rigid airship—with which types alone we are concerned at the moment—all the stresses have to be met by the pressure of the gas and the strength of the fabric, this method has the disadvantage of putting the top surface of the envelope in compression, though it was many years before this fact was fully appreciated. A modification of this system was, indeed, adopted in the first British airship, the "Nulli Secundus," which was provided with broad bands of fabric carried over the top surface of the envelope, the car being slung from the extremities of these bands, which terminated at about the "equator"—to employ a ballooning term—on a level with the longitudinal axis of the airship. In the majority of modern airships, therefore, the point of suspension will be found to be at or below the longitudinal axis when the rigging is external though this is not the case usually in the various internally-rigged types.

"Rigging Band" Suspension

The most usual method nowadays is the employment of a "rigging band," which consists of a strip of fabric—generally two or three ply—sewn and stuck around the envelope either at the circumference or near the bottom surface. The latter method has the advantage of reducing the size of the rigging band and so saving weight.

Who was the first to introduce this method the present writer is unable to say with exactitude, as illustrations of early airships are in the majority of cases so indistinct and details so vague that it is difficult to say with certainty whether the rigging band is actually stuck to the envelope or whether it is merely the termination of a net or fabric covering over the top half of the envelope. It was, at any rate, used in the early Parseval airships, and also in most of the French Lebaudy, Astra and Clement-Bayard types. More definite information on this point would be interesting. The "Nulli Secundus" in its later form had a rigging band, while retaining the fabric or webbing bands for the handling guys.

The Parseval System

In 1912 (British Patent No. 4915) the German Parseval Airship Company (Luft-Fahreug-Gesellschaft), of Bitterfeld, invested a system of "trajectory bands" in conjunction with a rigging band, which has been embodied in all their airships built subsequently. This consists in carrying fabric bands transversely round the envelope from the rigging band on each side, along the lines of maximum stress, instead of circumferentially round the envelope as in the older superficially similar method.

Santos-Dumont in his airships usually employed a bamboo fastened longitudinally to the airship, from which the car was suspended.

The Crow's-foot Method

The only other system of external rigging which has been adopted of recent years is that of dispensing with the rigging band and attaching the rigging guys direct to the envelope by means of crows-feet. This is obviously only applicable to airships of very small size, as it involves a considerable local strain on small portions of the total surface of the envelope.

Types of Cars

Up to the present we have only dealt with the method of distributing the ultimate strain of the weight of the car over the surface of the envelope as far as the attachment to the envelope is concerned, and it is next proposed to deal with what may be described as the other end of the problem—the size of the car, and the resulting angles of the rigging guys. It will be readily appreciated that the longer the car the more easily can the weight be distributed and the more vertical the rigging guys will be, and a few moments' reflection will show that a long car also admits of closer rigging to the envelope, because, if a short car be employed close to the envelope, it is impossible to carry the guys to the more distant points of the envelope, except at a prohibitive angle.

A long car, however, involves increased head resistance, increased weight—which is augmented by the fact that the car must be of greater proportionate strength to resist the increased stresses produced by the length—and waste of space.

This difficulty is got over in the semi-rigid school by employing a rigid girder-keel close under the envelope or—in the case of the "Veeh" and some other types—attached to and following the curvature of the envelope, from which the car is suspended instead of direct from the envelope itself.

This is a compromise which is now practically obsolete, though it still exists in a somewhat specialized form in the case of the majority of Italian airships, which will be dealt with later.

The semi-rigid system has always seemed to the writer a somewhat ignoble begging of the question, as it involves most of the disadvantages of the long car non-rigid system without providing any real solution of the problem.

(To be continued)

A. Leo Stevens, instructor, U. S. Army Balloon School at Fort Omaha, and Captain Davison, Mr. Stevens' assistant

FOREIGN NEWS

FRANCE

Paris, Aug. 8.—The French authorities learn that during the night raids in July, when French aeroplanes bombarded Treves and Essen, the Germans forced French and English prisoners, both officers and men, interned at Karlsruhe to leave their quarters and remain in the open, where they most probably would be hit in case the raiders reached Karlsruhe.

The men were compelled to remain in these places until all danger had passed.

Paris, Aug. 11.—In the region of Mont Blond, two German airplanes were brought down by French pilots on August 10, and two other machines, seriously damaged, were forced to land within their own lines. Our aviators successfully effected various bombing operations. The aviation ground at Schlastadt and the encampments in the forest of Houthulst received many bombs.

In reprisal for the German bombardments of Nancy and the region north of Paris, two French machines piloted by Lieut. Mezergues and Sub-Lieut. Beaumont, on August 11 dropped bombs on Frankfort-on-the-Main, one of the most important cities of the German Empire, having a population of more than 300,000. Both machines returned undamaged.

GREAT BRITAIN

A thrilling instance of the amazing superiority of the British airmen over the Germans in the Flanders battle of July 31 was given by Major General Frederick B. Maurice, Chief Director of Military Operations at the War Office.

"During the afternoon," he said, "one of our airmen, cruising aloft several miles behind the German lines, spied a German Staff car containing four staff officers speeding along a country road. He swooped down and chased the car five miles. The excited passengers, while urging the chauffeur to find shelter, stood up in the car, drew revolvers and fired wildly into the wings of the big bird circling overhead.

"The British pilot finally got the car into the right position in front of his machine gun, and swept it with a hail of bullets, killing two of the officers. The other two passengers rushed to a farmhouse for refuge.

"On the day of the attack the weather conditions were as nearly impossible as could be imagined—low clouds of great density, haze and mist. The observation was almost nil, and as a result the artillery was under a severe handicap, having to work without adequate aeroplane observation.

"But the aeroplanes were enormously busy in other departments. More than 100 engagements were fought by aeroplanes with the forces of the enemy on terra firma, our 'planes in these cases descending often to within less than fifty feet of the ground and sweeping the enemy with their machine guns or bombing them. The enemy aeroplanes were well nigh helpless to interfere.

"Less than twenty fights in the air occurred, because the enemy did not dare come up, and in these fights we downed six enemy machines, while we lost only three of our own. There were eleven cases of machine-gun attacks on German airdromes by British machines. Our airmen swooped down to an altitude lower than the treetops and fired string after string into the German hangars, killing mechanics, damaging machines and blowing up workshops. Similar attacks were made repeatedly on parties of marching troops, on working parties and on transports.

"We won this absolute command of the air only by persistent aeroplane offensive during the weeks before. There is no evidence that this mastery is permanent. We shall have to fight again for it, but our airmen are confident that they can repeat again when necessary."

British naval aeroplanes on the night of August 9 dropped several tons of bombs on the German airdrome in the Belgian town of Ghistelles, south of Ostend; on the Zuidwege railway sidings and on the Theurout railway junction, the British Admiralty announced to-day. On Friday afternoon British airmen dropped bombs on the German airdrome at Sparappelhoek. The Admiralty statement says:

"Several tons of bombs were dropped by the Royal Naval Air Service Thursday night on the Ghistelles airdrome, on the Zuidwege raidway sidings and on the Theurout railway station junction. Dense clouds of smoke were caused at Zuidwege. The railway junction at Theurout also was attacked by gunfire from the air.

"On Friday afternoon, a further bombing raid was carried out on the airdrome at Sarappelhoek. All our machines returned safely."

Canadian Headquarters in France, Aug. 11.—The great efforts now being made in Canada and the United States to assure supremacy in the air during the final stages of the war are viewed here at the front with keen and sympathetic interest.

Reports from our front this morning record that aeroplanes yesterday attacked the enemy's observation balloons which were directing his gunfire from points well behind the front. One balloon was brought down in flames, and three smoking, as the result of machine-gun fire from our aeroplanes.

Another fighting machine flew along the enemy's front line trench at an average height of only thirty feet and engaged the occupants with a machine gun. At one point it dipped within six feet of the ground. On its return to its airdrome, some German telephone wire was discovered wound around the machine.

Twenty-three persons, including nine women and six children, were killed and fifty persons were injured at Southend, in Essex, forty miles east of London, by bombs dropped by German air raiders on August 12.

"Enemy raiders," says the report, "caused considerable damage at Southend, where they dropped about forty bombs. The casualties thus far reported are:

"Killed, eight men, nine women, six children. About fifty people were injured.

"At Rochford two men were injured, but no damage is reported. At Margate four bombs were dropped. One uninhabited house was demolished, but there were no casualties."

An earlier bulletin said:

"About 5:15 o'clock this afternoon a squadron of about twenty enemy aeroplanes were reported off Felixstowe (in Suffolk).

"They skirted the coast to Clacton (Essex), where they apparently divided, a part going south to Margate (in Kent). The remainder crossed the coast and went southwest toward Wickford, near which place they turned southeast and dropped bombs in the neighborhood of Southend (in Essex). Some bombs also were dropped on Margate."

London, Aug. 12.—The intrepidity of Captain William Bishop, a Canadian and a member of the Royal Flying Corps, in attacking a German airdrome single handed has been rewarded by the bestowal upon him of the Victoria Cross, the most prized of the British valor medals. The Official Gazette gives the following account of the action:

"Captain Bishop flew first to an enemy airdrome. Finding no enemy machine about he flew to another airdrome three miles distant and about twelve miles inside the German lines. Seven machines, some with their engines running, were on the ground. He attacked these from a height of fifty feet, killing one of the mechanics.

"One of the machines got off the ground, but Captain Bishop, at a height of sixty feet, fired fifteen rounds into it at close range and it crashed to the ground. A second machine got off the ground, into which he fired thirty rounds at 150 yards. It fell into a tree. Two other machines rose from the airdrome, one of which he engaged at a height of 1,000 feet, sending it crashing to the ground. He then emptied a whole drum of cartridges into the fourth hostile machine and flew back to his station.

"Four hostile scouts were 1,000 feet above him for a mile during his return journey, but they would not attack. His machine was badly shot about by machine gun fire from the ground."

It is reported in an Exchange Telegraph dispatch from Lausanne that no more Zeppelins are being constructed at Friedrichshafen.

Thousands of workmen, who hitherto have been employed in building airships are now said to be engaged in the construction of a large number of aeroplanes.

HOLLAND

Flushing, Aug. 8.—A German seaplane stopped a Dutch fishing boat near Westkapelle. One of the airmen went aboard and ordered the boat to Zeebrugge. While the boat was still in territorial waters, a Dutch patrol vessel met it and brought it to Flushing. The German airmen were captured and made prisoners.

Rotterdam, Aug. 6.—A German seaplane alighted at Texel, Holland, after being fired at by Dutch soldiers. It was short of gasoline. The occupants were interned.

ITALY

The American consul at Turin, Italy, sends the following report to the State Department:

The firm of Pomilio & Co., of Turin, intends to inaugurate an air transport service between this city and Rome. Permission has been accorded by the Italian minister of posts and telegraphs for the carrying of mail between the two cities and the surrounding sections, and until special stamps have been issued by the Government the ordinary "express" or "special delivery" stamp of $0.05 is to be used, with a note made on the envelope that the letter is to be sent by airplane. No stamp other than the "special delivery" is required, but the using of this stamp for this particular service does not imply the delivery of the letter by special messenger to destination, as would ordinarily be the case. Special letter boxes are to be placed in the post offices and railway stations in both Rome and Turin wherein letters for the air post may be deposited.

Rome, Aug. 7.—A detailed report on the air raid at Pola, the Austrian naval base, on Friday night, following the raid of Thursday night, shows that it began at 11 P. M. and ended soon after dawn. Each Italian machine carried eight bombs and six grenades. The first members of the squadron arrived over Pola an hour after their departure, and the last at 4 A. M. They carried out their task, which comprised a flight of 320 kilometers (nearly 200 miles), 160 of which were over enemy territory, without the loss of a single machine.

D'Annunzio, the poet, was aboard one of the larger planes, piloted by Captain Gori. The damage effected was most important. The arsenal was bombed and a naphtha depot and a seaplane station were set afire and burned like paper. The Italian aviators, who kept at an average height of from 2,500 to 3,000 yards, were able to judge of the extent of the destruction by the enormous sheets of flame and columns of smoke which shot up to a height of 500 yards.

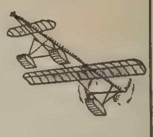
The Austrians were unable during the bombardment to extinguish any fires started by the bombs, but they kept up a furious fire with their anti-aircraft guns, and thirty of their most powerful searchlights threw dazzling beams over the space where the Italians were flying. Notwithstanding, the latter cruised over the city for nearly five hours and escaped unhurt and victorious.

During the recent Italian aerial raid on Pola, the Austrian naval base on the Adriatic, two aeroplanes with bombs destroyed two Austrian submarines which were being repaired there.

"During the evening of August 9, Italian fliers, strongly escorted, bombarded the enemy's military works in the Chiapovano Valley, dropping three tons of high explosive. Intense anti-aircraft fire was of no effect, and numerous hostile pursuing aeroplanes were strongly attacked by the Italian machines and forced to withdraw. One was seen to land in the direction of Planina, east of Monte Nero. On August 8 an enemy aeroplane, after a brisk fight with an Italian chasing machine, was forced to land near Tolmino. Another enemy machine was brought down west of Flondar. The airmen were made prisoners."

MODEL NEWS

Edited by G. A. Cavanagh



CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.

LONG ISLAND MODEL AERO CLUB
401 Grant Ave., Cypress Hills, L. I.

BAY RIDGE MODEL CLUB
6730 Ridge Boulevard, Bay Ridge, Brooklyn

INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.

BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.

THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Mr. Travers Ayers' Ornithopters

An Interesting Study for Model Flycrs

Some of the earliest, if not the earliest, of man's endeavors to conquer the realm of the air—so far, that is, as aerial travel is concerned, were made by man-worked machines of the flapping type. It was nature's method of solving the problem, then wherefore not man's? No success of any practical good was obtained, nevertheless these experiments were not without value, and if some of the accounts, even when due allowance is made for great exaggeration, are to be believed, some success, of a very limited character it is true, was obtained. So far as I remember, the particular instance I have in mind was a machine in which the man, by suitable mechanism, was able to use all the most powerful muscles of his body, legs as well as arms, at the same time. A comparison can be drawn between this and rowing by comparing the ordinary attempts at "man-flappers" to a man rowing a boat in the usual way and in the other case to a man provided with a sliding seat by means of which the powerful leg muscles are brought into play as well as those of the arms. We must also never forget that the motored machine of the present day with all its almost incredible achievements is the direct outcome of the man-carrying glider experiments of Lilienthal, Pilcher, Chanute and the Wrights, supplemented and indeed rendered possible only by the advent of the internal-combustion motor. Bearing these facts in mind and remembering that there is always more tha none way of doing anything, it is only right and indeed only sensible that attempts to solve the problem of flapping flight should be placed on record even if they have not in themselves met with any great practical success—at the stage at which they were abandoned. We can neglect nothing in this direction, because we do not yet know where the germ of success lies. Success always come through failure.

Under such circumstances, and taking a broad and perfectly unbiased view of the subjejct, we present this week to our readers some drawings and particulars of two machines with which Mr. Travers Ayers has carried out some experiments.

The machine has a wing span of 25 feet and weighs 50 pounds. To manipulate this ornithopter the pilot, whose shoulders are suitably strapped to BB, stands on platform A, the weight of the man upon which pulls down CC, and the latter being fastened to the wing arms forces them in an upward position. Upon the pilot relieving A of his weight and transferring it to BB, and by resting on the shoulder straps, the movement of the wing arms is thus reversed, and the flapping of the wings is accomplished by the weight of the pilot being alternately transferred from A to BB. In the drawing some of the bracing, wires, etc., have been left out for the sake of clearness of the method of working.

This machine has a wing span of 16 feet and a tail span of 5 feet; it is designed on the principle of the vulture.

The main arms are of bamboo and follows the placement of the bones in the bird. To these are attached the ribs of the feathers, which are of tapering canes; the whole length of these are drilled with holes through which are fastened the bristles from a stiff broom; the whole is then covered with light waterproofed material. The tail is constructed on the same principle.

(To be continued.)

Flying Kites to Study Weather

(Concluded from page 789)

The entire study of the upper atmosphere as carried out by the Weather Bureau under Doctor Blair's direction is comparatively new. The Hargrave box kite, used for the observations, is not a quarter of a century old, despite the age of kite flying itself, and too sensational results cannot be expected in so short a time. Without going into the subject too far it may be said that kite flying has brought out facts which, when correlated with other material, will, it is believed, produce interesting results. In general all winds are from a westerly direction if one goes high enough. It is not unusual for the wind to be from the southeast on the ground. A half mile up it may be from the south, while a mile up it quite probably is from the southwest. Observations made with kites have shown that a mile and a half above sea-level the moisture content of the air is one-third what it is at sea-level and at three miles one-tenth.

Some interesting facts regarding upper air temperatures have been determined by means of kites. In discussing this phase of the subject Mr. Sherry said: "In the winter during the night the temperature grows warmer for the first quarter to half mile of altitude. In the summer it grows colder usually up to an altitude of about eight miles. During the coldest part of a summer morning it will sometimes be somewhat warmer a few hundred feet high than it is on the ground. While in the winter it will be warmer a few hundred feet above the ground at night, during the day it will be a little colder. At all other times the temperature will, as a general thing, decrease with altitude up to what is sometimes called the 'isothermal layer.' The altitude at the base of the isothermal layer varies from day to day and also with the seasons. It is usually found at about eight miles above the level of the sea, but it may very from six to ten miles above sea-level. In the isothermal layer the lowest temperature is usually found. With the aid of sounding balloons self-recording instruments have been carried to altitudes as high as twenty miles above sea-level. These instruments indicate that above the base of the isothermal layer there is very little change of temperature with altitude, although sometimes it grows a little warmer above the base of the layer.

(To be continued)

An Interesting Invention

Recently Mr. Frank L. Dyer of Montclair, N. J., filed the following patent which was passed upon. The description follows:

1. A toy in the form of a traveler adapted to be supported by a kite or other inclined string, and a propelling plane carried by the traveler for driving the same along the string by wind pressure, the propelling plane being inclined with its lower edge forward of its upper edge so as to secure a lifting effect, substantially as set forth.

2. A toy in the form of a traveler adapted to be supported by a kite or other inclined string, a pair of pivoted wings presenting surfaces by which the traveler will be propelled along the string by wind pressure, the wings occupying a normal position at a small angle rearward of the axis and a spring normally holding the wings in this position whereby when resistance to forward progress is encountered the wings will automatically collapse forwardly of the axis by wind pressure to permit the traveler to return by gravity, substantially as set forth.

3. A toy in the form of a traveler representing a flying machine adapted to be supported by a kite or other inclined string, and provided with a propelling plane by which it will be driven along the string by wind pressure, said propelling plane being arranged at an angle with its lower edge forward of its upper edge, by which a lifting effect will be secured, substantially as set forth.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Fledgling (nervously) "Shall I mark time with my feet, sir?" Lieutenant (sarcastically)—"My dear fellow, did you ever hear of marking time with the hands?" Recruit—"Yes, sir; clocks do it."—*Puck.*

She—Were the American Sammies happy when they started for France?

He—Happy? They were in transports.—*Brunonian.*

I sometimes have spasms and break out into verse, but the following is not mine:—

Hail to thee, high flyer,
Who with generous heart
Pourest out thy fire
Over earth's dim chart,
In sundry spasms of well premeditated art!

Now this is an ode to the thing the searchlights seek at night. There is the high flyer, the generous heart, pouring out fire, premeditated art. The last line drags a bit, but no matter. Also, I would suggest a better, though similar sounding name for the initial word. Here is the second verse:—.

Like a monstrous bird
Overseas thou comest;
Melodies unheard
Through the heavens thou hummest,
And bombing still dost soar, and soaring ever bombest.

Somehow or other that last word does not seem to rhyme. but it is probably one of the spasms of well premeditated art. Shades of Shelley that his beautiful "Ode to a Skylark" should have been strafed so remorselessly.

As a set-off, here are some by a boy reader who says he is 11 years of age. He says it is "Poetry," and I will take his word for it. In any case it is original and shows some promise:—

Up and out to reconnoitre.
Up above the clouds to loiter.
Out to make a reconnaisance.
Out to make them make obeisance
To the British R.F.C.

You should see the Vickers' Fighter
Empty on a German "blighter."
You should see the deadly Fokker
Sent to Davy Jones' locker
By the British R.F.C.

You should see the Bristol scouting.
You should see the Avro routing,
Then, afterwards, the German doubting
If he's got an R.F.C.

Ruthless Rhymes

The following brief but poignant verse has been sent by a reader, Mr. Alan Hill Reid:—

Flying low I chanced to meet
Auntie walking in the street.
From the Will of Auntie Bella
I have bought a new propeller.

This having been received with much joy at the offices of *The Aeroplane* the Staff Poet has now produced other verses, having each with a similar fuselage and more or less the same horse-power. Here are a few:—

Billy, landing his Morane,
Nearly ran into a barn,
Collided with a neighbor's donkey—
Both the tails have now gone "wonky."

* * *

Bertie on his Blériot,
Climbed as high as he could go.
At 12,000 got the cramp. . . .
(For details send a penny stamp.)

* * *

Careless Charles, about to loop,
Filled his petrol-tank with soup,
Filled his Thermos flask with Pratt's—
And filled the church-yard with top-hats.

* * *

This is why the flight-sub-loot
Got the Order of the Boot:
As his map was upside down
He had bombed a friendly town.

* * *

Heinrich in the Zeppelin car
Kept on leaning out too far.
"Himmel!" said the captain, stopping,
"What was that fell out at Wapping?"

D. W. T.

[Any further suggestions?—Ed.]

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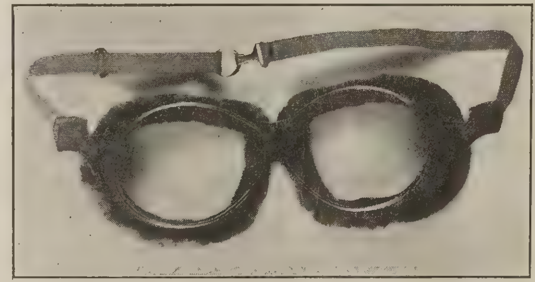

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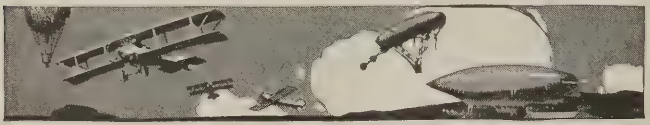

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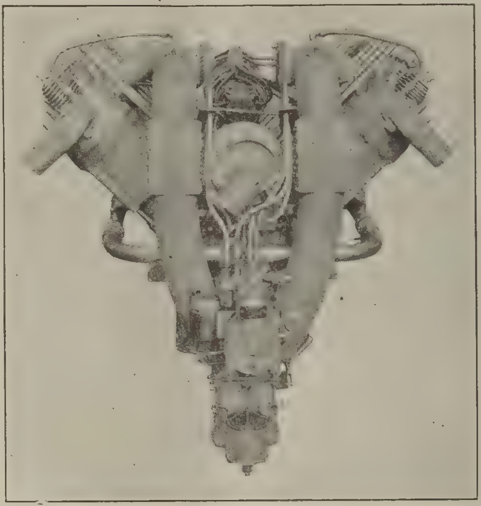

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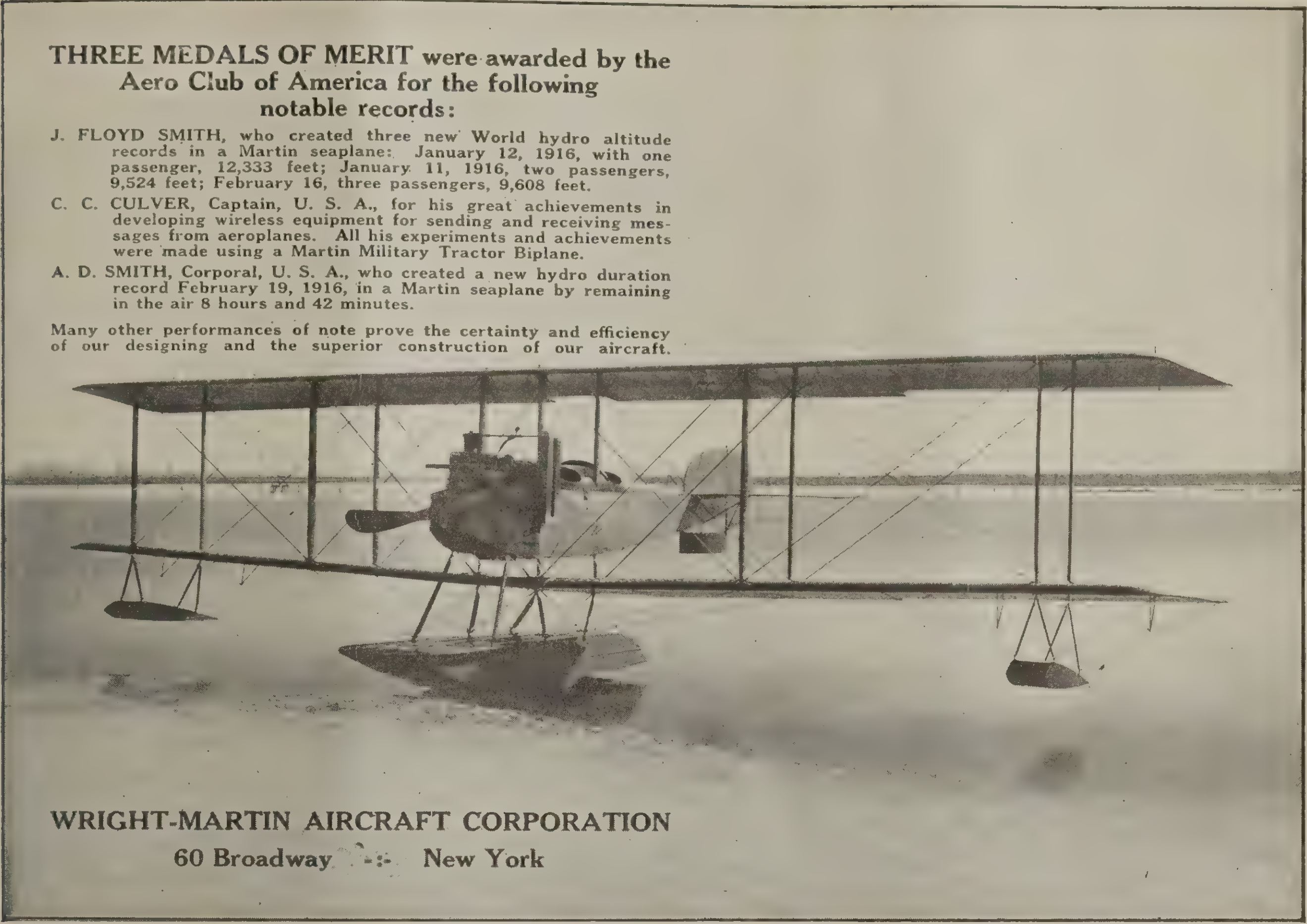

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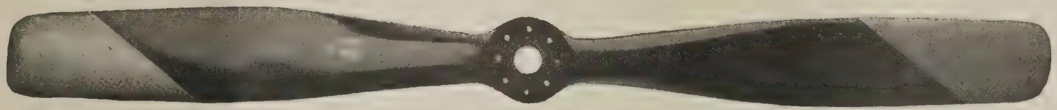

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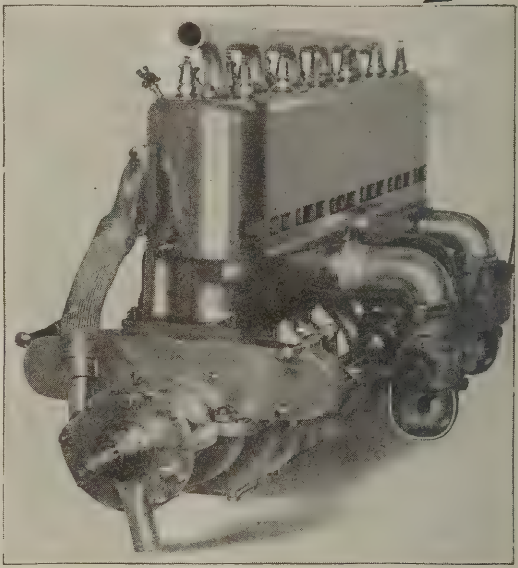

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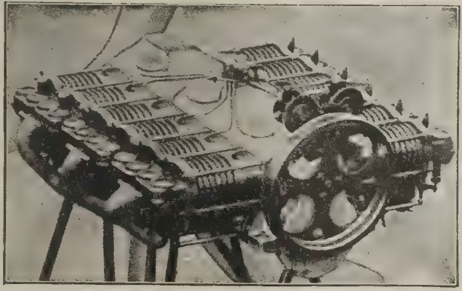

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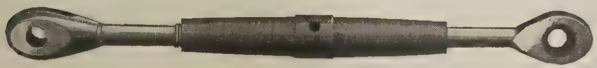

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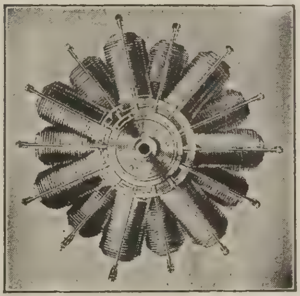

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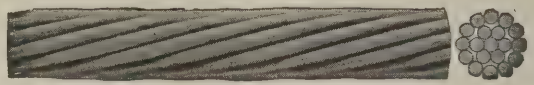

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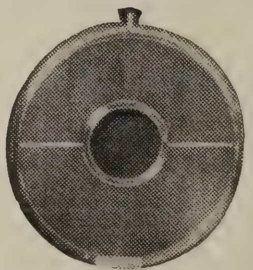

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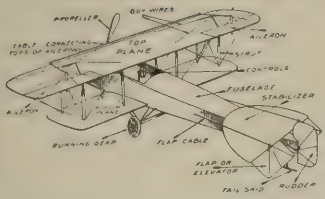

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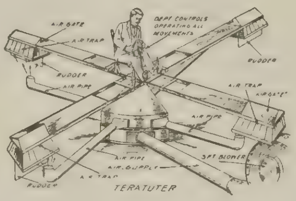

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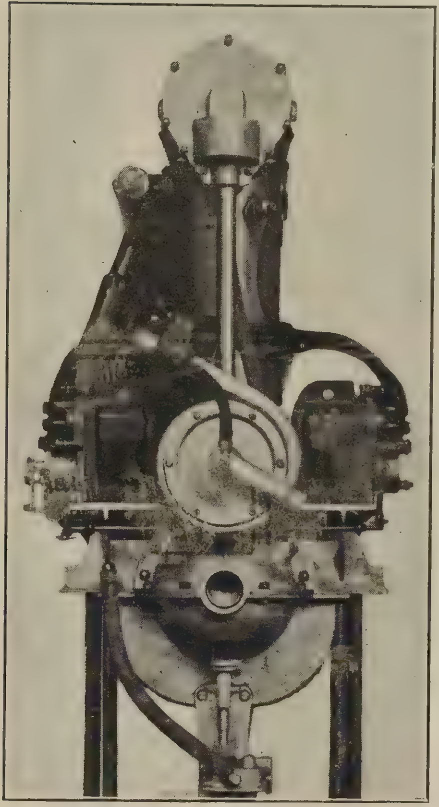

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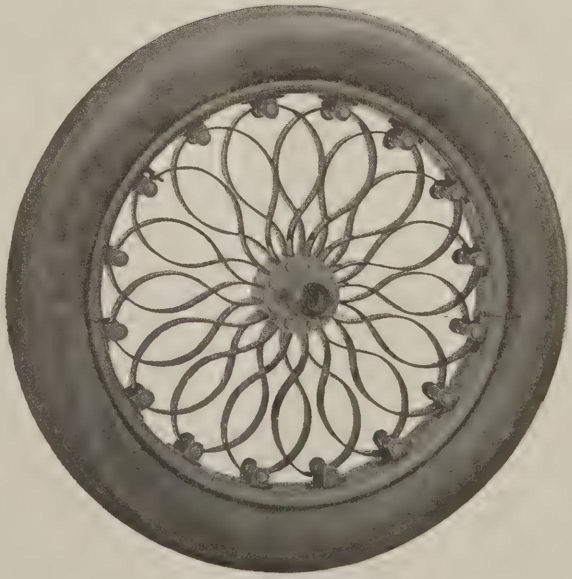

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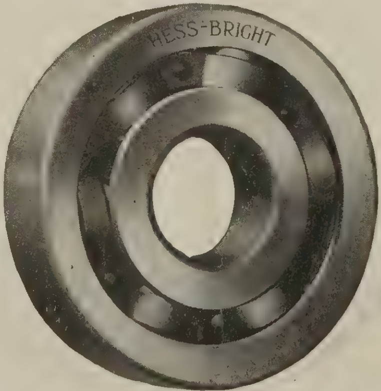

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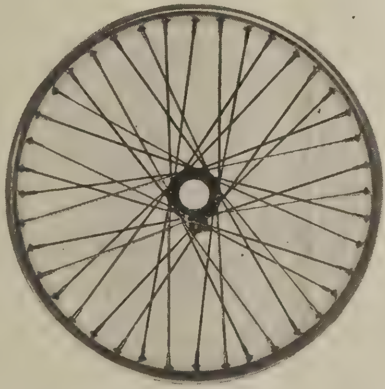

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VOL. V NEW YORK, AUGUST 27, 1917 No. 24

REAR ADMIRAL BRADLEY A. FISKE POINTS OUT HOW GERMAN SUBMARINE CAN BE ELIMINATED

REAR ADMIRAL BRADLEY A. FISKE has written the following letter to the Aero Club of America, pointing out how the German submarine can be eliminated and the German Navy attacked with aircraft.

The letter, which is addressed to Mr. Alan R. Hawley, President, Aero Club of America, and was sent from Jamestown, Rhode Island, where Admiral Fiske is at present, reads as follows:

"My dear Mr. Hawley:

"During the past five months I have had the honor of writing you a number of letters, which pointed out the capabilities of powerful aeroplanes for offensive use in war, the advisability of sending a large force of aeroplanes to Europe, the paramount menace of the submarine and the ability of aeronautics to overcome that menace.

"The present war has shown such complete preparation, not only in material but also in strategic plan on the part of the Germans, and such a far-sighted view of the possibilities of submarines supported by mines and a fleet, that the desirability became obvious six months ago of replying with some unexpected method or device, which the Germans had not provided against in their plans.

"The mere killing and wounding of individual men has never of itself determined the result of any modern war; because the men who are not killed or wounded were able to keep up fighting, if supplied with adequate food-fuel and munitions. What has decided the result of every modern war has been the shutting off of the means of effective fighting; sometimes by stopping the transportation of troops, food, fuel and munitions, and sometimes by the actual taking of the seat of government of one of the belligerents. In our Civil War, public attention was fastened on the land battles, by reason of the number of men engaged in them, and the terrible destruction of life and limb. The land fighting kept up without decisive advantage to either side, until the naval blockade had seriously reduced the supplies that came from Europe; but as soon as the blockade had become effective in this way, the Confederate Army ran short of munitions and equipments, and could no longer fight effectively. Then the Confederate Army was defeated, and Richmond, the capital, lay defenseless before the troops of Grant.

"In our war with Spain, the operations of the Army in Cuba and the Philippines exercised little influence on the outcome of the war; but the destruction of practically the entire Spanish Navy at Manila and Santiago left Spain so obviously exposed to blockade and attack by our fleet, that Spain gave up at once. In the war between Russia and Japan, tens of thousands of soldiers were killed and wounded in Manchuria, without apparent result; but as soon as the Russian fleet was destroyed in the naval battle of Tsushima, the Russians saw their inability to transport troops and munitions to invade the island empire of Japan, no matter how many Japanese soldiers they killed in Manchuria; and so they came to terms of peace. The battle of Tsushima had an effect curiously like Nelson's battle of Trafalgar, which prevented Napoleon from transporting troops and munitions to invade the island Kingdom of Great Britain.

"In the present war, hundreds of thousands of soldiers have been killed and wounded in France, seemingly without effect; but the German submarine, without destroying many lives in comparison with the number of lives destroyed by the armies, has been effecting a continuous reduction in the means of transportation by which the Allies get the food, fuel and ammunition which they need to prosecute the war. Thus far, the submarine seems to have been a more potent factor in deciding the result of the war than all the armies on both sides. As in the wars just mentioned, it has been operations on the sea, not operations on land, that have been the most important factor.

"The Navy of Germany has scarcely been attacked at all, although her navy is inconsiderable in comparison with her army, and although, if her navy were destroyed or even crippled, Germany's only hope of victory, the submarine, would be eliminated. Her navy has not been attacked, because it has been believed to be too heavily entrenched behind mines to justify an attack by sea craft. This was skillfully arranged by Germany in the light of conditions as they were before the war.

"But before the war, aeroplanes were small and unreliable, and the powerful bombing plane and torpedoplane had not shown their capabilities for offensive use, unhindered by mines and submarines. These weapons constitute a new and unexpected agency; so that we seem forced to the serious—the very serious—consideration of using them against the naval ships of Germany, now safely entrenched behind miles of mine fields, from which they send forth their submarines to destroy the commerce of the world.

"I trust that you will agree with me in the ideas which I have just expressed, and that you will, whenever occasion warrants, bring them to the notice of influential people. Your position as President of the Aero Club of America, and the record of the Club for patriotic service of the highest order of disinterestedness and efficiency, mark you as especially fitted to bring before the people the ability of aeronautics to assist their cause.

"With great esteem, I am,

"Very sincerely yours,
(Signed) "Bradley A. Fiske."

FRENCH GRATIFIED AT PROPOSED AMERICAN AERONAUTICAL CO-OPERATION

MAURICE DE SAINT BLANCHARD, secretary of the Aero Club de France, who is in a particularly good position to express an opinion on American aviation projects, discussed the American programme with a New York *Herald* correspondent recently. He said:

"It is very gratifying to see the splendid 'elan' of the Americans, who press forward to make American aviation a great force in this war. America can be proud of what she has done by contributing virile and courageous aviators before she joined the Allies. France takes deep interest in American aviation."

When asked about the reports that America wanted to put a hundred thousand aeroplanes in the war Mr. de Saint Blanchard said:—"It is a big figure. I hardly think the rapidity of construction could keep up with a steady flow of ideas and inventions. We estimate the cost of a single machine at

$7,000 to $8,000, and we have been a long time at this sort of work. I should think it logically or theoretically possible. But what interests me is how would the American manufacturer set about this big job."

Mr. de Saint Blanchard pointed to a design on the wall and said:—"Another point is that models are changing constantly. That design informs our aviators of all models used by the enemy. It was issued last April, but every day some new feature is invented. We see a new model to-day which goes quicker to-morrow or higher another day or has a new motor the next day.

"This is true of French and Germans alike. Our aviation is equal to the German aviation and we have decidedly superior pilots. I believe it would be a good scheme to send American aviator pupils to France to study conditions here from the start or nearly from the start."

In commenting on the opinions of America's aerial programme and progress, as expressed by Maurice de Saint Blanchard, secretary of the Aero Club of France, Henry Woodhouse, a governor of the Aero Club of America, said:—

"The Aero Club of America is very close to the Aero Club of France, and I am delighted to learn that the French think we are doing our part and are awake to the aeronautic situation. This will encourage us in our determination to go ahead and do our part toward defeating Germany through the air.

"We will surprise Europe by the large number of aeroplanes we will manufacture as a result of the activities of the Aircraft Production Board and the Aircraft Manufacturers' Association, backed by public sentiment and liberal appropriations by Congress. It is safe for us to promise to produce many aeroplanes other than the thousands needed for training by next spring.

"It is possible that by then we shall be able also to produce hundreds of large bomb dropping machines for major aerial operations against U-boat bases and the German fleet, as well as against German military centres on land. These large types of aircraft will be capable of flying for eight or ten hours without stopping and to carry a load of from 2,500 to 3,000 pounds in bombs.

"These machines will be capable of long distance flights at night, to much greater advantage than smaller ones, and will be invisible even to other aeroplanes in the sky one hundred feet away.

"As regards small fighting machines, it is true they cannot be made without constant changes in design or other features, which, needless to say, would preclude the possibility of America turning out this type in large numbers while building the other types, but the small fighting machines number only about twenty per cent of all aircraft used.

"The other machines, only five or ten miles slower in many cases, are used for artillery spotting, photographing, scouting, bomb dropping, &c., and the purpose of the faster fighting machines is to clear the skies for the slower ones.

"Of course, aeroplanes now are used in tens of thousands, and, of necessity, it will be some time before the United States will supply more than a fraction of the machines needed, because even two thousand a month cannot be considered a great addition. However, America will respond to the demand in a way that will surprise France."

LARGE AEROPLANE ORDERS REPORTED PLACED ABROAD

A DISPATCH from Paris, under date of August 15, states that large contracts for aeroplanes have been placed in Allied countries, and that the machines will be delivered soon. The despatch, which has been printed by all the metropolitan papers, reads as follows:

Paris, Aug. 15—The American aviation service announces that large contracts for aeroplanes have been placed in Allied countries and that deliveries will begin soon.

The American Aviation observers who were sent to the British, French, Italian and Russian fronts are prepared to make a detailed report on aerial warfare as carried on by Allied aviators.

Several months ago a statement was printed in the press to the effect that orders had been placed for a large number of aeroplanes abroad. The Aero Club of America wrote to prominent Washington officials and was advised that there was no truth to the statements. The fact was that if such orders had been placed in France and England, we would have been competing with the French and British Governments at a time when they found it impossible to get all the areoplanes they needed.

Were they getting all the aeroplanes they needed it would nevertheless be imposing a burden on our Allies by limiting, instead of increasing our sources of supply.

THE EAGLE'S BROOD

Be Ready for Air Drives

(Editorial in New York Evening *World*)

THE recommencement of German air raids on Paris, with the reported bombardment of a Red Cross hospital, should only strengthen the determination of this country that American air fleets on a scale bigger than any yet dreamt of shall speedily bear down on the barbarian and his strongholds.

It is eighteen months since Zeppelins made the last air attack on the French capital. The Zeppelin is now a discarded murder tool. But the Germans apparently have hopes of using aeroplanes for the slaughter of non-combatants in France as they have employed them for the same purpose in England. It matters little that this sort of terrorization has utterly failed to terrorize. For the Teuton, frightfulness has come to be its own reward.

England, and France too, may see fit to avenge their dead and insure a larger degree of safety for the living by reprisals in kind. America's air legions, however, need set themselves no programme which involves the deliberate killing of women, children and wounded. There is plenty of genuine war work for aircraft on and close behind the enemy's lines. The nature of that work was pointed out by Congressman Murray Hulbert to the *World:*

"A fleet of 25,000 planes along the Belgian front, a second on the Champagne, a third of 25,000 on the Italian front and a fourth on the eastern front would shower havoc upon the armies of the Central Powers. Starting from their several bases, the stupendous air fleets could cause untold wreckage to the enemy and with immeasurably less loss of life to our forces than would result from one great trench battle. A fleet of 10,000 planes flying at great height, every machine loaded with high explosives, could wipe from the earth every munition plant and fortification for miles into the enemy country."

Germany's air strength, present or contemplated, is obviously impossible to state in trustworthy figures. The German authorities give out only such as they wish to have believed. But whatever it is, the air strength of the Allies must be brought to and maintained at a point where superiority is certain and lasting.

That is where America must come promptly forward. With one hundred factories at work on air machines, Great Britain admits it cannot keep up with its demand. France has no workmen to spare. Italy eagerly awaits the coming of American air forces, convinced that America "can send no more telling aid to attain a quicker victory."

To American plants and American machinery the Allies look for quantity in aeroplane production. It is up to American resource to see to it they do not look in vain.

The News of the Week

Lumber Commission Has Successful Trip

The special aeroplane Lumber Commission which started for the Pacific Coast on August 2nd, and which has since returned, met with an enthusiastic reception at every one of the places visited. The Commission consisted of Captain Henry Danrif, Major R. Perfetti, Lt. Col. L. W. B. Rees, L. A. Casbaldi, Italian Engineer; W. C. Chadeayne, manager Curtiss Aeroplane Co., and E. T. Allen of the lumber committee of the Council of National Defense.

The newspapers of Grand Rapids, Seattle, Tacoma, and Portland gave enthusiastic accounts of the rousing reception given the Commission and the inspiring addresses delivered by members of the Commission. Major Perfetti summed up the situation when he said: "We want spruce. You must give us spruce and we will win the war in the air."

No Aircraft to Neutrals

Washington,—American made aeroplanes are not to go to neutrals. The export council today placed planes and aircraft engines on the embargo list.

The action was taken on discovering that neutral countries were placing orders in this country for aircraft. To prevent such orders interfering with the aeroplane programme of this Government and her allies no machines will be allowed to leave the country except when approved by the Aircraft Production Board and licensed by the export council.

Spruce Lumber for Aeroplanes

Portland,—Members of the Allied Aircraft Commission are in Portland today to confer with lumber manufacturers relative to increasing their production of spruce lumber for aeroplanes.

The Commission includes Lieutenant-Colonel L. W. B. Rees, of the British army; Major Raffaelle Ferfetti, of the Italian army; Captain Henri Dourif, of the French army, and F. T. Allen, of Portland, representing the National Council of Defence.

Personal Pars

Mr. Perceval Dodge, who learned to fly at Miami and who passed the tests at Mineola on July 7, has since received his commission as First Lieutenant, Aviation Reserve Corps.

Aeromarine Seaplanes at Bayshore

What is believed to be the first instance of the aerial delivery of a seaplane direct from factory to Government aviation field was accomplished Friday, August 11, when an aeromarine machine of the advanced school type was driven from the factory of the Aeromarine Plane and Motor Company, at Keyport, N. J. to Bay Shore, L. I. With Lieutenant Reed at the wheel and accompanied by Lieutenant Gillespie, the trip was made without incident, the sixty-five mile journey being accomplished in fifty-five minutes. It is noteworthy in that at least twenty-four hours were saved in delivery. Delivery by motor truck requires six hours in actual transportation time from Keyport to Bay Shore in addition to the time required to disassamble for shipment and assembling on reaching the aviation field.

By aerial delivery these machines, which are so sorely needed at this time, can be sent to their destination immediately folowing the conclusion of the factory tests.

Rapid Progress in Curtiss Expansion

The immense new plant of the Curtiss Aeroplant & Motors Corporation at Buffalo will be ready for business by October 15. Previous estimates had indicated that the plant would not be finished before January 1.

Despite the fact that the land for the new plant was only secured three weeks ago, all of the foundations have been laid and two of the bays have been completed. Four miles of track, giving the company the very best of railroad connections, have been laid.

The new plant will occupy nearly 100 acres of land, and will increase present capacity over 600 per cent.

Above facts indicate that the big Government work for aeroplane and parts will be well under way by November 1. It had not been expected that anything of a substantial character would be started before January 1.

By the closing two months of this year the Curtiss Co. will be in a position to turn out anywhere from $6,000,000 to $8,000,000 of aeroplanes and parts a month. This means business greater each month than was done by the company in the first seven months of the current year.

By the first part of 1918 it is expected that business will be turned out at close to $10,000,000 a month and if there is no falling down in present plans the capacity will ultimately be brought up to better than $12,000,000 a month.

Cutting Lumber for Aeroplane Fleet Begun

Seattle.—The cutting of spruce lumber in the forests of Washington and Oregon for the nation's proposed fleet of aeroplanes, has begun, when two camps in southwestern Washington, closed by strikes, and one in northern Oregon resumed operations.

Each of the three camps is capable of cutting 100,000 feet of timber daily.

New Aluminum Castings Plant

Aluminum Castings Co., Detroit, is building an addition which will be twice the size of the present building, and expects to begin operations in the new plant about September 1.

Ford Company Making Aero Engine Cylinders

Detroit.—Henry Ford announces that the Ford Motor Company is now making 200,000 steel airplane cylinders for the United States Government which are to be delivered at the rate of 1,000 per day.

"We have just developed a way of making these cylinders from solid steel, and they can be manufactured very cheaply," said Mr. Ford. "If called upon to do so this output can be increased to 5,000 or even to 10,000 a day. It costs very little more to produce steel now than it did before the war."

The matter of price has been left to the Government after the cylinders are completed, the Government officials and Mr. Ford to figure the cost and the bill to be settled without profit to the Ford company.

New Zenith Plant

Zenith Carbureter Co., Detroit, is building an addition to its present factory which will permit an increase of 80 per cent in production capacity.

De Palma's Packard Wins Races

New York City:—Ralph De Palma, premier sprint driver of America, wrested the speed championship from Barney Oldfield, Saturday afternoon, August 18, when he sent his twelve-cylinder Packard to victory in all three events of the first big Eastern auto races here this season.

Amid the cheers of 35,000 spectators De Palma won the thirty-mile race in 16 minutes 35 3/5 seconds, the twenty mile contest in 10 minutes 52 3/5 seconds.

In the longest contest of the day, the fifty mile race, De Palma sent his cream colored Packard along at the rate of 109 miles an hour, finishing in 27 minutes 32 1/5 seconds. Owing to the fact that no official timers of the A. A. A. were present this will not be considered a record, although it was said to be the fastest time for the distance made in a race by a car of less than 300 cubic inches piston displacement.

Katharine Stinson, who was to have flown from Albany to the Speedway to race with Oldfield and loop the loop, got only as far as Athens, N. Y., twenty-eight miles south of Albany, according to news reaching the track. Tex La Grone of the Staten Island aviation school interested the spectators by an exhibition of flying which did much to relieve the disappointment caused by Miss Stinson's inability to appear.

The official time for the three events is as follows:

Thirty Miles—Won by Ralph De Palma, Packard. Time, 16 minutes, 35 3/5 seconds, Louis Chevrolet, Frontenac Special, second; Barney Oldfield, Golden Submarine, third.

Twenty Miles—Won by Ralph De Palma, Packard. Time, 10 minutes, 53 4/5 seconds; Louis Chevrolet, Frontenac Special, second; Barney Oldfield, Golden Submarine, third.

Fifty Miles—Won by Ralph De Palma, Packard. Time, 27 minutes 32 1/5 seconds; Barney Oldfield, Delage, second; Louis Chevolet, Frontenac Special, third.

The International Aircraft Standardization Committee, which met in Washington August 14-15 for the first time. Seated, left to right, F. G. Diffin, U. S., Chairman; G. L. Norris, U. S.; Lieut. M. Mignot, France; Capt. J. Herck, France; A. B. Rogers, England, and S. G. Payne, England. Standing, P. D. Merica, Bureau of Standards; F. G. Ericson, Canada; W. F. Prentice, England; Capt. A. Pomilio, Italy; J. S. MacGregor, U. S.; H. Chase and Dr. G. K. Burgess, both of the U. S. Bureau of Standards

Fliers' Transfer Unlikely

Paris—There has been considerable discussion as to whether the Lafayette Escadrille will be transferred to the American forces or will remain, as at present, an integral part of the French Army. It appears probable that the existing state of affairs will be maintained, as there seem to be difficulties in the way of what might appear to be the simplest procedure—constitution without further formalities of the whole escadrille as a unit of the American air force.

If the question were put to a vote among the members of the escadrille themselves there is little doubt that they would be practically unanimous in favor of their present status, as they not only feel that, having served France thus far, they wish to remain part of the French Army until the end, but they have been told that to enter the American air force they must pass certain examinations. They naturally point out that their brevets as French pilots and employment in fighting Germans on the French front are the best possible guarantee of their competence, and they cannot understand why, after such experience, they should be put on a level with comparative novices entirely unfamiliar with European war conditions.

Aeroplane Mail Service in Mexico

City of Mexico, Aug. 10.—Mexico has established regular mail service by aeroplane from Mexico City to Vera Cruz, from Mexico City to Queretaro, and from Mexico City to Pachuca, the first being covered in 4 hours, the second in 2 hours and the third in 45 minutes.

Army and Navy News

Majors B. D. Foulis and T. De W. Willing, junior military aviators, are rated as military aviators.

Major H. Parsons will report to Brig. General J. E. Kuhn, General Staff Corps, office of the Chief of Staff, for temporary duty in that office.

Captain W. S. Cornell, from Fort Benjamin Harrison to Belleville, Ind., as medical member of the examining board, Signal Corps Aviation School, and by letter to Central Department.

Captains R. M. Colt and J. A. Northrup, Aviation Section, will report to Chief Signal Officer for duty in his office.

1st Lieutenant E. R. Kenneson, Aviation Section, is announced as on duty requiring him to participate regularly and frequently in aerial flights on May 9 last.

1st Lieutenant F. K. Lane, Jr., Aviation Section, to Washington, D. C., to report to Chief Signal Officer for duty.

Orders of July 28, relating to Captain H. Elliot, Aviation Section, amended to read Captain H. Elliott.

Captains W. Wadsworth and P. H. Jennings, Aviation Section, will report to Commodore General, Eastern Department, for duty.

Capt. H. F. Wehrle, to Ft. Sam Houston, Texas, and report to Com. Gen. Southern Dept.

1st Lt. L. W. Stevens, Aviation Sec., to duty requiring regular and frequent aerial flights.

1st Lt. H. C. Drayton, aviation sec., to Mount Clemens, Mich., and report to Com. Officer Sig. Corps Aviation School.

Maj. A. Trowbridge, Aviation sec., to Washington, D. C., and report to Chief Signal Officer of the army.

Capt. J. W. Butts, to Mineola, L. I.

Lt. Col. C. D. Chandler, to New York, N. Y., temp. duty in connection with Aviation Service.

W. T. Thomas, pioneer aeroplane designer and Vice-President of the Thomas-Morse Aeroplane Corporation

Capt. Thomas G. Gallagher, Aviation Section, Signal Officers' Reserve Corps, is assigned to active duty and will proceed to Washington, D. C., and report in person to the Chief Signal Officer for duty.

Capt. Clarence C. Culver, now detailed in the Aviation Section of the Signal Corps, is rated as junior military aviator.

Capt. P. De L. Boal, Aviation Section, is assigned to permanent duty in the office of Chief Signal Officer.

1st Lieut. L. Schenk, Aviation Section, will report to Com. Gen. Southern Dept. for duty.

The following officers of Aviation Section will report to Com. Officer, Selfridge Field, Mt. Clemens, Mich., for duty:

First Lieutenants—W. P. Jacob, L. L. Snow, H. P. Trainer, C. F. Smythe, T. E. Tillinghast, T. H. Webb.

1st Lieut. B. L. Corson, Aviation Section, to Ft. Sam Houston, for duty.

1st Lieut. P. Dodge, Aviation Section, to Chanute Field, Rantoul, Ill., for duty.

1st Lieut. J. M. Foote, Aviation Section, to Rantoul, Ill., for duty at Aviation School there.

1st Lieut. T. Boland, Aviation Section, to Selfridge Field, Mt. Clemens, Mich., for duty.

Capt. L. B. Lent, Aviation Section, to Buffalo, N. Y., re aviation duty.

1st Lieut. H. B. Close, Aviation Section, to Ft. Sam Houston, for duty.

The following of Aviation Section will report to Com. Officer, Chanute Field, Rantoul, Ill., for duty:

First Lieutenants—E. W. Kilgore, W. H. Murphy, W. W. King.

1st Litut. J. H. Hyman, Aviation Section, to Southern Dept., for duty.

The Late Henry Souther

Major Henry Souther died in the hospital at Fort Monroe August 15 following an operation. He had been sick for only a few days and there had been no hint that his illness was serious. His death is a great loss to the U. S. Aviation Department, for he held the post of Senior Officer in the Aircraft Engineering Division, had had far more experience than most of his colleagues, and possessed an exceptional organizing ability in addition to scientific attainments of a very high order. His loss will be felt by the automotive industry as a whole with equal severity.

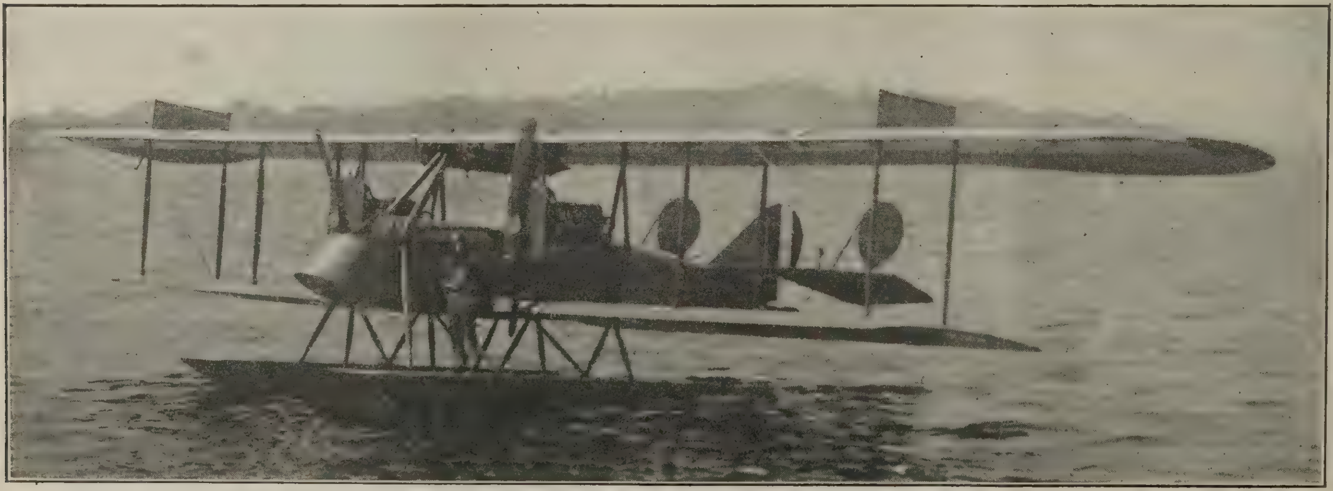
Henry Souther has been a prominent man in the automobile world for many years. He was the father of standardization, starting the great work in the days of the A. L. A. M. before the creation of the S. A. E. He was the first chairman of the S. A. E. standards committee and served for three years, from 1910 to 1913, during which time the steel standards were enormously elaborated beyond what the A. L. A. M. had done, while many of the other most important standards were created. Henry Souther in this work had far more to do than to act as a committee chairman, for he had the task of convincing a reluctant industry of the value of standard. He was the greatest salesman the standardization idea ever had. Far-sighted and clearthinking, he could not only see the great value of standards to manufacture, but he was gifted with the ability easily to transfer his convictions to others. During his presidential year, 1910-1911, the S.A.E. made vast strides forward and he was always, up to the day of his death, prominent in any work that the society undertook.

Mr. Souther was born in 1865, educated in Boston schools and the Massachusetts Institute of Technology, where he took a course in mining and metallurgy. He was with the Pennsylvania Steel Co., Steelton, Pa., for six years, then with the Pope Mfg. Co. for six years, in charge of materials and as general consulting engineer. His automobile associations started in metallurgical and other research work in the bicycle days. He later did much work in the A. L. A. M. laboratory and was a consulting engineer specializing in metallurgy for many important automobile and bicycle concerns. In 1912 he joined the Standard Roller Bearing Co. and went to England to study the manufacture of Rudge-Whitworth wire wheels, afterward starting the Standard Roller Bearing Co. on similar lines. In 1914 he became general manager of the Ferro Machine & Foundry Co., Cleveland. Here he remained until taking up his military appointment last year. The rank of Major was given Mr. Souther just after the declaration of war by the United States. He was a life member of the S. A. E., and was also at the head of the Souther Engineering Co., of Hartford, Conn.

Personal Pars

R. E. Olds, president of the Reo Motor Car Co., has offered his Oldsmar property in Florida to the Government for three years without charge for an aviation camp.

William B. Stout has given up his duties as manager of the aircraft division of the Packard Motor Car Co., Detroit, to go into aircraft work for the Government in Washington.



The latest twin-motored Burgess Seaplane, at Marblehead, Mass.

Army and Navy News

Major G. A. Reinberg and Capt. S. H. Wheeler, Junior Aviators, Signal Corps, from Southern Dept., to Scott Field, Belleville, Ill., for duty as officer in charge of flying and assistant officer in charge of flying, respectively.

1st Lieut. D. G. Frost, Aviation Section, is announced as on duty, requiring him to participate regularly and frequently in aerial flights.

1st Lieut. W. H. Warren, Aviation Section, will report to the Chief Signal Officer for duty.

Capt. W. K. Evans, Aviation Section, will report to Com. Gen., Central Dept., for duty as assistant to the Dept. Intelligence Officer.

Major R. D. Smith, Aviation Section, will report to the Chief Signal Officer for duty in his office.

Orders of July 20 relating to 1st Lieut. G. W. Muller, Aviation Section, revoked. He is assigned to active duty and will proceed to Chicago for duty in Central Dept.

1st Lieut. J. G. B. Molten, Aviation Section, to Scott Field, Belleville, Ill., for duty as disbursing officer.

Capt. C. M. Foss, Aviation Section, to Scott Field, Belleville, Ill., for duty as engineer officer.

1st Lieut. F. Netcher, Aviation Section, to Ft. Sam Houston.

1st Lieut. F. L. Isbell, Aviation Section, is announced as on duty requiring him to participate regularly and frequently in aerial flights.

Major H. B. Kirtland is honorably discharged.

Canadian Aviators to Train in Texas

It was announced today at the headquarters of the British Recruiting Mission, 280 Broadway, that Lieutenant H. B. Denton, now in charge of recruiting cadets for the Royal Flying Corps, will soon leave for Texas to lay out an aviation camp for the Canadians.

This camp in Texas will mean still closer cooperation between the aviation sections of the American and British forces and a further standardization of methods and actual work. Many American fliers are now being trained in Canada.

The plan is to reproduce in Texas an aviation school like Camp Borden, Camp Mohawk, Camp Rathbun, Camp Seaside and Camp Armour Heights. Lieutenant Denton was responsible for the laying out of the Canadian flying grounds. A large number of the cadets recruited in New York will be sent to Texas to finish their training.

Supplementary to the enrolment of cadets, the British mission is enlisting skilled mechanics and workmen for the maintenance and repair of the airplanes and engines of the squadrons in Canada. Automobile engine fitters, carpenters and sailmakers are the most needed just now. They may apply at 280 Broadway.

What the Governors of the Several States of the Union Think of Air Service in War

The Aeronautical Department of the Northeast has decided to give out for publication the opinions of the Governors of the States as fast as received and later to publish them in pamphlet form for preservation and general distribution.

The following have been received at headquarters:

"The immediate raising and equipment of a formidable Aviation Army appeals to me as one of the most important pressing duties of the present war situation. I believe that the importance of this branch of War service will be more and more in evidence as time passes and that we should spare no effort or expense in hastening effective work on this line, and I shall hope and work for a good representation from New Hampshire in the Air Army."

HENRY W. KEYES,
Governor New Hampshire.

"I believe extensive and effective participation by the United States in aeronautical activities necessary to early conclusion of the war."

HENRY C. STUART,
Governor of Virginia.

"The sooner America's Aviation Army is made ready for service the sooner the end of the war will be reached and the fewer American lives will be sacrificed."

KEITH NEVILLE,
Governor of Nebraska.

"Upon aviation more than any branch of service depends the success of this war. A trained air service in action to-day would in my opinion bring the war to a speedy close. I shall make public your telegram and get through the press expressions of support from our citizens."

JOHN G. TOWNSEND,
Governor of Delaware.

"Aviation assistance is of greatest possible importance, its imperative value is being demonstrated daily and I hope to see large increases in our air forces without delay."

PETER NORBECK,
Governor of South Dakota.

"Regard air service in war as being of paramount importance. Should be adequate and ready, coincident with other contingents."

W. E. LINDSEY,
Governor of New Mexico.

Lieut. C. E. Ruttan, the first Naval Militiaman to pass the "Naval Aviators" tests

"Although the Governor is out of the city, I am authorized to say that he believes the most effective and quickest way of achieving victories of decisive importance over Germany is by the United States conducting major aerial operations over her territory."

W. E. HENDERSON,
Private Secretary.

"The value of the airship in war has been demonstrated beyond controversy by the war in Europe and the supremacy of the air is necessary as an adjunct of the forces on land and sea to the successful consummation of that war."

JOHN J. CORNWELL,
Governor of West Virginia.

"The aeroplane is playing an important part in the war in Europe. I know of no line in which the U. S. can render greater service in this war than by constructing aeroplanes and training men to properly operate them."

ERNEST LISTER,
Governor of Washington.

"Am of the opinion that air service in war can be made very effective. Glad to offer my services in the organization of the service."

FRANK L. HOUX,
Acting Governor of Wyoming.

"I think that the United States should make it a point to raise and equip the greatest Aviation Army in the world, so that the eyes of the enemy would be effectively destroyed."

R. G. PLEASANT,
Governor of Louisiana.

"Air service extremely important in present war; insufficient men and equipment deplorable; every effort should be exerted to increase this valuable branch of our military organization."

JAMES WITHYCOMBE,
Governor of Oregon.

"The proposed organization of America's Aviation Army of 25,000 aviators and observation balloon pilots will have the unqualified commendation and support of the citizenship of Arizona. Our young men will help fill this quota. Be assured that Arizona realizes that in her co-operation in this direction she is assisting the surest and quickest means of terminating the war against Prussian dominion."

THOS. E. CAMPBELL,
Governor of Arizona.

"Admittedly no branch of the service is of greater importance than the air service. Every energy should be exerted to make it highly efficient to the end that our part in the struggle will be marked by substantial success."

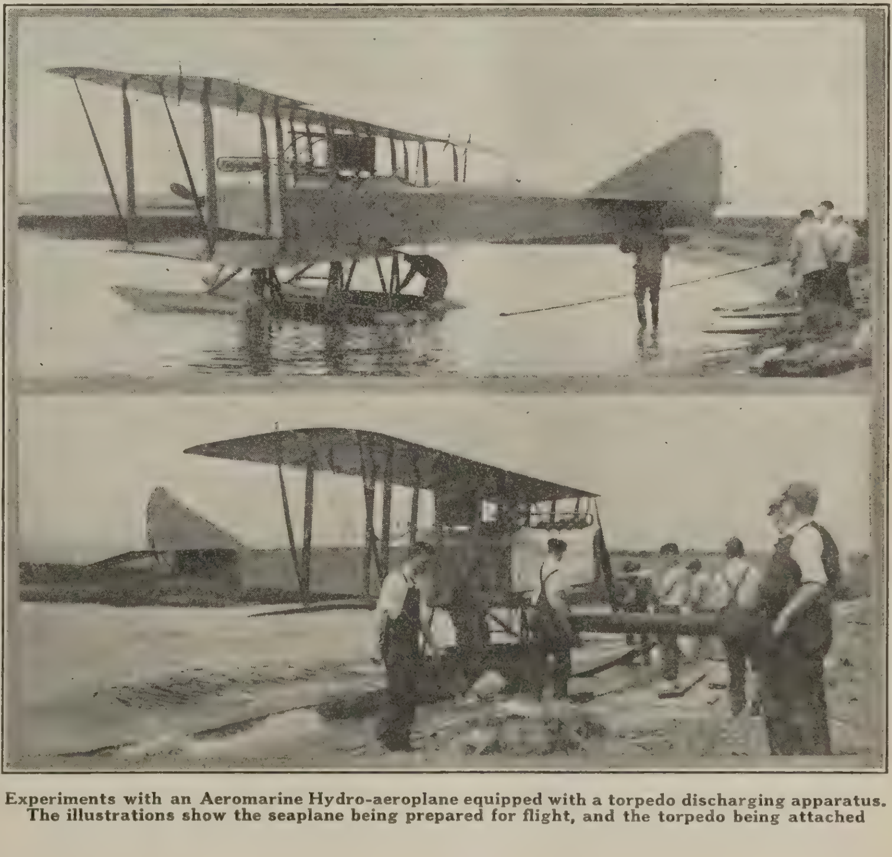
SAMUEL W. McCALL,
Governor of Massachusets.

"The importance of an effective Aviation Army cannot be over-estimated. The outlook is that this army will be very important factor in bringing this war to victorious conclusion. South Carolina wishes you godspeed in making it up."

RICHARD I. MANNING,
Governor of South Carolina.

"The aviator has been called the eye of the Army, but as the great war has progressed he has been even more than that, adding force to sight and becoming arm as well as eye; the Asviation Corps is indispensible, and it is most fitting that America, the land in which the airplane originated, shall endeavor to bring this arm of the service to a state of highest efficiency in no way can the United States render a greater service in the war."

ARTHUR CAPPER,
Governor of Kansas.



Experiments with an Aeromarine Hydro-aeroplane equipped with a torpedo discharging apparatus. The illustrations show the seaplane being prepared for flight, and the torpedo being attached

DROPPING BOMBS FROM AEROPLANES

An Ingenious Instrument Employed by the Germans

By JEAN-ABEL LEFRANCE

LAST February a French aviator, Capt. Guynemer, succeeded in bringing down inside the French lines, one of a raiding squad of 20 German bombarding planes of the newest type manufactured by the Gotha Wagonen Fabrik. A peculiarly interesting feature was the Goerz sighting telescope or range-finder, designed to facilitate the taking of correct aim at objects to be bombarded. A careful study of this, with a discussion of the laws governing the dropping of bombs on definite objects, appears in *La Nature* (Paris), together with the accompanying diagrams.

Any projectile dropped from a height is subject, of course, to two constant forces, the resistance of the air and the acceleration due to gravity. Its trajectory is a vertical line from the point of discharge A to the striking point, B (Fig. 1). If the bomb be dropped from an airship in motion it will have an initial speed equal to and in the same direction as that of the latter. This new force is compounded with the two former and the result is the curved trajectory A C.

If this bomb, having a given initial velocity, is dropped into a layer of air in motion, that is, into the wind, it is acted on by the latter, and is said to undergo "drift." If the wind is at the back the trajectory is lengthened as in A D; if there is a head wind the trajectory will be shortened as in A E.

If the bomb be dropped from an avion which the strength of the wind causes to be stationary with respect to the ground, *i. e.*, when the velocity of the wind is exactly equal to that of the avion and in the opposite direction, the projectile will have no initial velocity and the curve of its trajectory will be a function solely of the drift produced by the wind, as in A *b*; it will therefore fall to the rear of the point of departure. This latter case, however, is exceedingly rare, since it presupposes a wind of 120 to 150 kilometers per hour; but this is a gale too high to permit the sending up of aviators.

These trajectories being given, the angle of aiming will be the angle formed by the vertical line A V at the point of departure A with the straight line joining this point A with the striking point O, *i. e.*, the angle VAO.

Since these trajectories are curves the height of the avion above the object aimed at is an element which modifies the value of the trajectory. Since the wind causes drift this drift will vary with the form of the projectile and with the velocity of the fall. Here we have two elements which are constant for each type of bomb.

To resume, the trajectory of a bomb discharged from an avion is the resultant of the following forces:

Weight
Form } Elements constant for a given type of bomb
Drift
Speed of avion in wind } Considered as a constant for a given type of avion

OTHER ELEMENTS

Height of shot
Initial speed of bomb, *i. e.*, of avion with respect to ground } Variable elements
Velocity of head wind

Of these three principal variable elements which it is necessary to know for each case of bombardment, one of them, the velocity of the head wind, can be immediately deduced when the velocity of the avion with reference to the earth is known, since this velocity of the wind is the difference between the velocity of the avion with respect to the earth and its normal velocity in the wind, an element which is fixed for a given type of avion.

Take an avion having a normal speed of 150 km. per hour; if it is only going 100 km. per hour with reference to the earth, then it is flying against a head wind of 50 km. per hour. Hence it is only necessary to know the height of the avion and the initial speed of the bomb to determine a trajectory. This method of calculating trajectories seeks to base itself on science in order to obtain a mathematical precision in its results. Unfortunately it is based upon a probable knowledge of atmospheric conditions, which are essentially capricious. Particularly, the speed of the wind at the height of the avion is taken into account, *e. g.*, at 4,000 meters, but it is supposed that this remains unmodified down to the ground, which is rarely the case in reality. It may also be that starting from 3,000 meters the wind changes its direction so much that the best calculations, the best telescopes, and the best bombardiers, are unable to secure a correct aim, so that some authorities despair of ever being able to get results in aerial bombardment comparable to the efforts made.

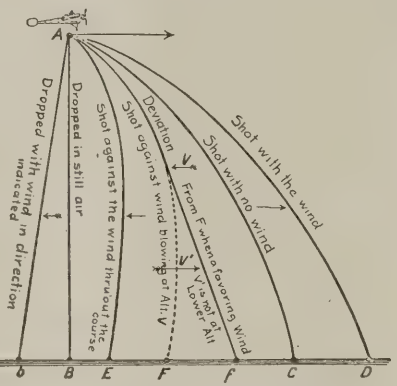

A
Dropped with wind indicated in direction
Dropped in still air
Shot against the wind thruout the course
Shot against wind blowing at Alt. V
Deviation
V
V'
V' is not at Lower Alt
From F when a favoring Wind
Shot with no wind
Shot with the wind
b
B
E
F
F
C
D

Fig. 1. Trejectory of a bomb falling from an aeroplane as affected by the direction of the wind

Goerz Range-Finder.—This is certainly the best and most highly perfected effort of German science to find means of destroying railroads, factories, and populations outside the range of their big guns. It consists of a telescope about one meter long; mounted on a universal joint, it can be oriented in every direction and kept strictly vertical whatever be the position of the avion (Fig. 2). The accompanying diagram (Fig. 3) shows the ensemble of the optical system; the field obtained is 500/1000 and the enlargement is 1.5.

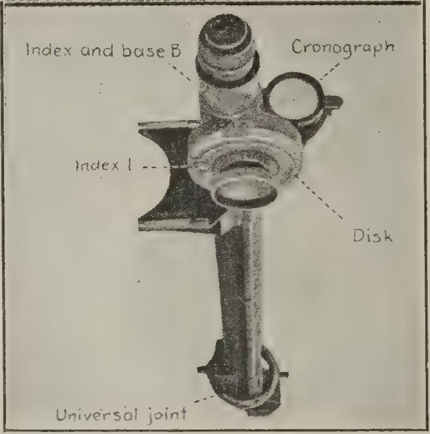


Fig. 2. The Goerz range-finder

At the base of this telescope is a prism mounted on a pivot and controlled by a graduated disk. The telescope remaining vertical the play of the prism permits the visual ray to be inclined a number of degrees corresponding to the graduations of the disk.

On this disk are two indexes, one corresponding to the vertical speed, or dead point of the range-finder and the other to the vision of 22° 30′. Another index serves as a basis; it is fixed on the body of the range-finder. At 0° the marksman sees the ground along the vertical (Fig. 4); at 20° the inclination of the visual ray is 20° in front of the avion (Fig. 5); at 5° the inclination is 5° behind the avion (Fig. 6).

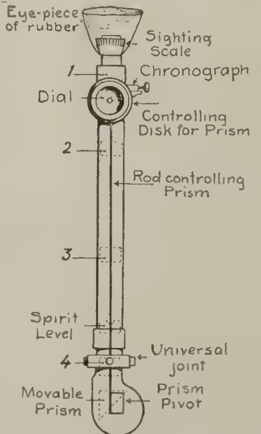


Fig. 3. Diagram showing construction of the Goerz range-finder

A small index is movable upon the disk but can be made solid with it by means of a little detent. This index once fixed before a graduation of the disk, after passing the dead point falls into a small notch, and thus informs the gunner that he sees the ground according to the inclination which he had marked with this index; this is disengaged by a slightly stronger pressure of the hand.

In the body of the telescope is a spirit level. The edges of the air bubble are refracted in such manner that they appear in the form of a black circle which serves as a sighting center for the telescope. In the course of all his range finding operations the gunner must keep this bubble in the center of the ocular, which will keep the range finder vertical no matter what the inclination of the avion is.

The universal joint permits the finder to incline freely from right to left or from front to rear, but when it revolves around its vertical axis, *i. e.*, when the visual ray, instead of being directed in front of or behind the avion, is directed to the right or the left of the route followed, the finder acts upon a route corrector. This consists of an electric device. Resistances act upon a very sensitive galvanometer placed in front of the pilot and indicate to him how to correct his route in order to make it pass exactly above the object to be bombarded.

Method.—There are only a few of the elements constituting a trajectory which can differ in the course of each bombardment: the height of the avion above the object, the initial velocity of the bomb, the speed of the wind. The German method of the Goerz finder enables a calculation of these three elements to be made.

1. The height is obtained by subtracting from the altitude range shown on the altimeter of the avion the altitude of the object bombarded; *e. g.*, if the avion is flying at 4,200 meters above sea-level, and if the factory to be bombarded is 200 meters, then the height to be reckoned with will be 4,200—200—4,000 meters.

This method, moreover, is subject merely to very slight errors where high altitudes are in question. Example: at 90 km. an error of altitude of 500 meters for an avion at 4,000 meters, corresponds to an error of only 25 meters at the ground level (Fig. 7).

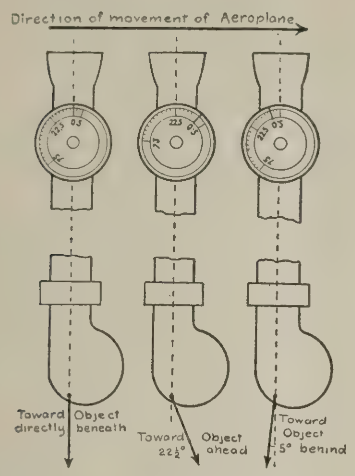
2. *Initial Velocity of the Bomb.*—In reality this is the speed of the bomb with reference to the ground. This element is the most difficult to know, because it varies with the velocity of the wind, which is in a state of perpetual instability. If an avion possesses a speed of 150 km. and the wind is blowing at the rate of 50 km., then with a following wind the avion will travel at 200 km. per hour, while with a head wind it will go only 100. This difference of speed considerably modifies the trajectories, as can readily be seen by examining the curves in Fig. 7, in which the avion is going 120 and 60 km. per hour respectively. In place of being simply added or subtracted this speed of the wind and speed of the avion may be compounded if the avion receives the wind for example ¾ to the rear (175 km. per hour) or three-quarters head on (125 km. per hour).

In principle, to simplify the calculations, the avion should bombard with the wind head on, *i. e.*, with the speed as much reduced as possible. To determine this kilometric speed of the avion we calculate the time required by a fixed point on the ground O to traverse an angle fixed at 45° or 22° 30′.

It is easy to see by the figure that the time required by an avion to find the range of the same point successively first with an angle of 22° 50′ and then vertically, is proportional to the speed of the avion with respect to the earth. A value in seconds is obtained.

A previously prepared table will indicate that if the avion being at an altitude of 4,000 meters, a point on the ground takes 36 seconds to pass through an angle of 22° 30, then the avion is going 100 km. per hour, with reference to the earth; if the point takes only 18 seconds to pass through the same angle the avion is going 200 km. per hour. This value is the initial horizontal speed of the bomb.

3. Moreover, it is known that avions of the Gotha type have 150 km. per hour speed when the motors are revolving at their usual velocity; if the preceding range finding shows the speed at the ground to be only 100 km. per hour, the obvious deduction is that the head wind has a value of 50 km.


Direction of movement of Aeroplane
22.5
0.5
7.5
Toward Object directly beneath
Toward 22½° Object ahead
Toward Object 5° behind

Figs. 4, 5, 6. Direction of aim in the finder

Thus all the elements of the trajectory sought are known; it remains only to read on the chart which firing angle is suitable to cause the bomb to fall on the given object, in view of the given elements.

Let us observe the application of this method to bombardment by means of the Goerz range-

Application.—The finder is under the control finder and its chart.

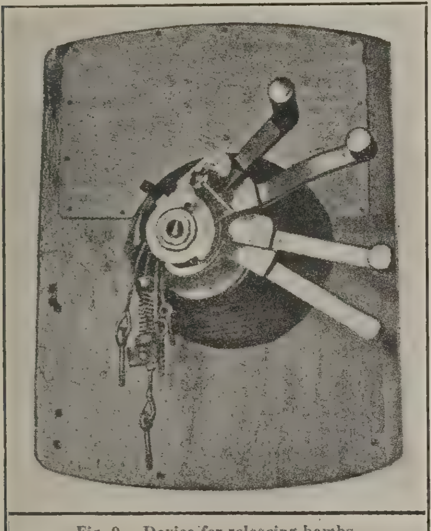


Fig. 9. Device for releasing bombs

of the forward gunner. The bomb releaser, in reach of his right hand, is worked by pressing on levers which liberate the bombs by means of flexible controls (Fig. 8).

Several minutes before arriving over the object to be bombarded it is necessary to acquire a knowledge of two elements which will enable the gunner to read on the chart the proper firing angle. The altitude range on the barometer less the altitude of the object gives the height of the fall of the projectile.

To obtain the second element which will give a knowledge of all the values of speeds we have recourse to the method of previous range finding of the ground, explained previously.

The index of the graduated disk is fixed at 22° 30′. The range of any point whatever on the ground forward of the avion is found—a route perpendicular to the one followed, a river, a house, the edge of a wood. This point is caught in the circle formed by the air bubble and followed while turning the disk until the index falls into the notch at the dead point; at this instant the seconds chronograph is released and the terrestrial point continues to be followed in the range finder until the 0° of the disk is checked at the dead point, the chronograph, immediately stopped, gives a number of seconds which, when found upon the chart in the line of altitude indicates the speed of the avion with respect to the ground and the sighting angle to make use of, for example, 10°.

The index is immediately set at the number of degrees of the sighting angle, *i. e.,* 10°. The observer is ready to operate. About 2 or 3 km. before flying over the object the latter is caught in the field of vision, then in the circle of the bubble. At this instant the route corrector operates and the galvanometer indicates to the pilot whether he is following a route which will make the avion pass directly above the object.

At the precise moment when the index fixed at the number of degrees of the sighting angle falls into the notch at the dead point, *i. e.,* at the moment when the finder aims with an angle of 10° the bombardier operates the bomb releaser and the bombs fall towards the object.

Throughout the whole bombardment the pilot must keep his craft strictly head on to the wind, the air bubble must be kept rigorously in the center of the ocular, the play of the prism alone serving to seek the object.

This Goerz range-finder is of an elementary simplicity for any one who has manipulated it in a few brisk actions. Its movable prism enables the object to be found with ease, its annular bubble permits it to be immediately centered in the vertical position. Marvelously constructed it appears to show marked progress over all previously made range-finders.

It eliminates errors except from new and practically incalculable elements, such as variations of forces and directions of the wind between the altitude at which the sighting is done and the ground, or when it becomes impossible to keep the avion head on toward the wind. The aim being at times scientifically perfect as the application of a method derived from calculations, does it folow that the bombs will fall directly upon the objects aimed at? Results loudly proclaim a negative. Hundreds of bombs discharged on railway stations, on famous ironworks, on important aviation terrains, have been without result except for a few shell "funnels" in the ballasts, a few laborers killed, some holes in hangars. Range finding is a delicate task to execute in an avion surrounded by bursting shells.

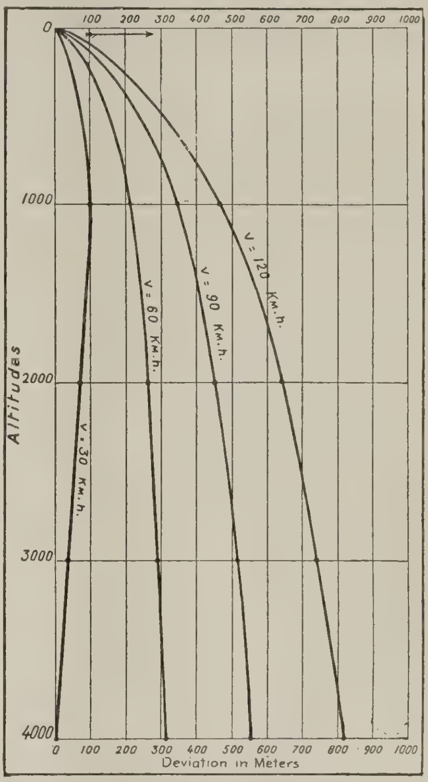


Fig. 7. The falling curves of bombs at different speeds

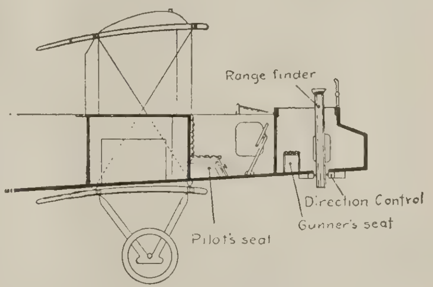


Fig 8. Location of the finder upon an aeroplane

THE COMPASS IN AERONAUTICS

By LOUIS A. BAUER *

THE recent great progress in aeronautical art and in the construction of ships to navigate the air, have called renewed attention to the importance of perfecting the magnetic compass used in steering the craft, and to the need of studying the "vagaries of the fickle needle." Just as in ocean navigation, it has become necessary in aerial navigation, though not yet to the same degree of refinement as in ocean work, to determine the effects on the compass of the magnetic materials used in the construction and in the equipment of the aircraft. The airship-compass must, accordingly, be compensated, and allowance for any outstanding errors must be made in steering a course with it.

The satisfactory solutions of the various problems are especially difficult for the heavier-than-air type of airship. One of the chief points of difference between the aeroplane compass and the ocean-ship-compass consists in the form of damping device (horse-hair packing, for example) which must be used to overcome, as well as possible, the very excessive vibration caused by the engine driving the aeroplane.

Besides the so-called "magnetic-deviation errors" of the compass, arising from the magnetic materials in the vicinity of the compass, there are other errors which make themselves seriously felt only, however, while the aeroplane is turning. The latter are called "dynamic-deviation errors"; their magnitude depends upon the tilt of the aeroplane, the magnetic dip, and the heading or course of the airship.

When the aeroplane is turning, it is tilted towards the center of the circle described by it, the tilt becoming greater, of course, with the speed of turning or with the decrease of radius of the circle. Everything movable which was at rest in the aeroplane during straight-line uniform flight under the action of gravity alone is still at rest relative to the aeroplane as it tilts on the turn, but now, everything is at rest under the action of the resultant gravity and centrifugal accelerations. The compass card, which was horizontal during rectilinear flight, is now tilted with the aeroplane and, consequently, partly turned in the terrestrial magnetic field. The vertical component of the earth's magnetic field, which was normal to the card in its level position in rectilinear flight and which, consequently, had then no directive effect, now as a component in the plane of the card and normal to the magnetic axis which tends to produce the "dynamic deviation." The horizontal component of the earth's magnetic field also plays a part in this kind of deviation.

According to some recent investigations in England by S. G. Starling,[1] when the angle of tilt of the aeroplane approaches the complement of the magnetic dip, which for Philadelphia would mean a tilt of about 19°, the dynamic deviations of the compass, if, for example, the course steered be an easterly one, may increase to nearly 90°. And if the tilt of the aeroplane exceeded 19° the direction of the compass on the course stated would even be reversed.

While the dynamic deviations may be large during turns of the aeroplane, yet they disappear, practically, when straight flight is resumed. We, therefore, question the desirability of adopting the movable compensating devices, suggested by Starling, which while effective during aeroplane turns, might introduce magnetic deviations of a more permanent character during the more usual straight flights. If his devices are used they will require careful control.

In connection with the use of the compass in aerial navigation, an interesting scientific question comes up as to the change of the earth's magnetic field, or of the magnetic elements with altitude above the surface. Magnetic experiments of this nature were made in balloons by Gay Lussac and Biot in 1804 which were repeated, with more success, a half century later by Glaisher. The available observations to date do not possess, however, the requisite refinement, and it is hoped that some day a non-magnetic airship and the necessary instrumental appliances will be available for conducting a magnetic survey of the aerial regions in the same manner as that employed in the oceanmagnetic survey of the non-magnetic ship, the *Carnegie.*

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* Paper presented before the American Philosophical Society.

[1] "The Equilibrium of the Magnetic Compass in Aeroplanes," *Phil. Mag.*, London, Vol. 32, November, 1916 (461-476).

INSTRUCTIONS FOR ASSEMBLING CURTISS STANDARD JN4-B AEROPLANES

(*Continued from page* 824)

Adjustment for Dihedral

(7) The fuselage must now be leveled up transversely and longitudinally. A spirit level placed across the two engine bed supports will determine the transverse condition. With the level placed fore and aft on the longerons aft of Station No. 5, or on the engine beds, the longitudinal level is established.

(8) Adjust the tension on the flying and landing wires until the dihedral of one (1) degree is established, also to make the leading and trailing edges parallel and straight. The amount of lift for the one (1) degree dihedral is 2¾" in 13' 6" (distance from the inner edge of the panel to the centerline outer post). An easy method for checking the correct adjustment of the dihedral is to place a block 2¾" high on the upper surface of the lower wing, at the extreme inner edge. A straight edge resting on this block and on the upper surface of the wing (straight edge kept parallel to front or rear beam) should be level, Fig. No. 9.

This may also be checked by using a light spirit level, suspended from a string stretched over the given range. If a block 2¾" high be clamped to the inner edge of the panel, and a line pulled taut from this block to the centerline of the outer beam, the level suspended next to the block will be sufficiently sensitive to determine the required degree of dihedral. Fig. No. 9 shows the arrangement diagrammatically.

If the outer end of the wings is too high, the landing (single) wires are too short and the flying (double) wires are too long. Hence, loosening up equally on the inner and outer, front and rear flying (double) wires, will correct this condition. If the panels are too low (dihedral not up to one degree), reversing the above method correct this condition.

Adjustment for Stagger

(9) The tension in the longitudinal cross wires is now adjusted for stagger. The distance between a plumb line dropped from the leading edge of the upper wing and the leading edge of the lower wing should be 12$\frac{5}{16}$ inches. If the amount is less than 12$\frac{5}{16}$ inches, the line leading from the lower wing front socket to the upper wing rear socket is too long. Hence, drawing up on this line and lengthening out on the cross line will correct this condition. If the distance is more than 12$\frac{5}{16}$ inches, reverse corrections of wire lengths (see Fig. No. 10).

(10) Check up the dihedral to see if this has been disturbed while setting stagger. Also check up with eye the alignment of the front and rear beam, and parallelism of leading and trailing edges. If these are not parallel, adjustment of the landing (single) wires in the inner bay (next to fuselage) will generally correct this condition.

(11) The wing skids on the under side of the lower wing should now be fastened to the sockets, directly under the outer posts.

(12) Bend all cotter pins out, and lock turnbuckles with safety wires. This latter is accomplished by first passing a soft wire through the eye of one shank of the turnbuckle, then winding the wire four to five times about the shank, the shorter, loose end of the wire being wrapped under the windings; then pass the free end through the small hole in the center of the barrel, then through the eye of the opposite shank, wrapping this free end around this shank and wire. This effectively locks the turnbuckles.

(13) The other side of the machine (right side) is then assembled in the same manner.

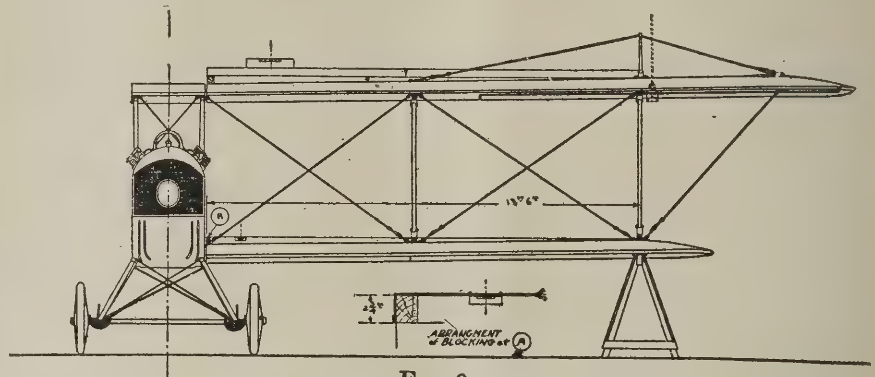


Fig. 9

(B) Second Method of Erecting Panels

The following outline method is given; the details of handling and adjusting of wires are identical with the details given for the first method:

(1) Insert masts (cabanes) into sockets and connect mast wires to anchor terminals. Adjust tension of mast wires until beams are straight.

(2) Connect upper panel to engine section and bolt upper end of struts into fittings.

(3) Jack up wing tip of upper panel so that lower panel can be connected.

(4) Connect lower panel to fuselage.

(5) Connect across diagonal wires.

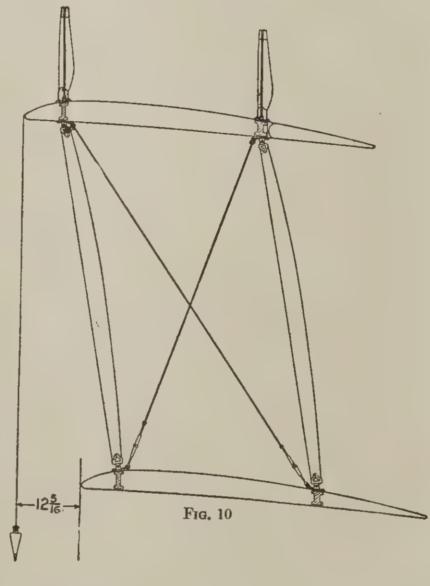


Fig. 10

(6) Bolt lower ends of struts into fittings on lower wing.

(7) Connect landing (single) wires.

(8) Connect flying (double) wires.

(9) Proceed in like manner with other side of machine.

(10) Remove jacks and level fuselage longitudinally and transversely.

(11) Adjust tension on landing (single) and flying (double) wires until the dihedral is one degree; leading and trailing edges are parallel and straight.

(12) Adjust tension on diagonal wires until stagger is 12$\frac{5}{16}$ inches.

(13) Attach wing skids.

(14) Bend cotter pins and safety wire turnbuckles.

12. Aileron Adjustment

Attach both ailerons (one on each side of machine, after having mounted control braces to ailerons) and fasten pins of hinges with the necessary cotter pins. Temporarily support ailerons so that their *trailing edges* are one (1) inch *below* the trailing edges of the upper panels. Then connect up the flexible tie-line that, passing over the top of the upper wings, through fairleads, is connected at the center by a turnbuckle, and, passing through pulleys attached to the upper surface, front beam, is attached (by shackle and pin) to the upper control brace of the aileron. This "lead" is allowed, so that when in flight, the force of the lift will somewhat raise *both* ailerons and bring their trailing edges on a line with the trailing edges of the panels. Now lead the end of the aileron control line attached to bridge through the hole in each side of the fuselage (between front and rear seats). Uncoil the connecting line which passes over the pulley attached to the lower surface of the upper wing, near the front outer post. Attach shackle and pin end to lower control brace of aileron, and attach turnbuckle end to loop of aileron control lead attached to bridge (and which passes through side of fuselage). In making this last attachment, the leads should be so arranged (by moving the wheel on the bridge) that the lengths projecting through the fuselage are equal.

13. Rudder Control Adjustment

Uncoil the lines attached to the rudder bar, to lead out through the upper surface of the rear end of the fuselage cover, and, keeping the rudder control bar at right angles to the longitudinal axis of the machine, fasten the ends to the control braces. Next take up the slack of the lines, by means of the turnbuckles, adjusting the tension equally in each set; the rudder control bar (foot control bar) should remain at right angles to the longitudinal axis, when the rudder is neutral (or in a vertical plane through this fore and aft axis).

14. Elevator Control Adjustment

Temporarily maintain the elevators in the plane of the horizontal stabilizer

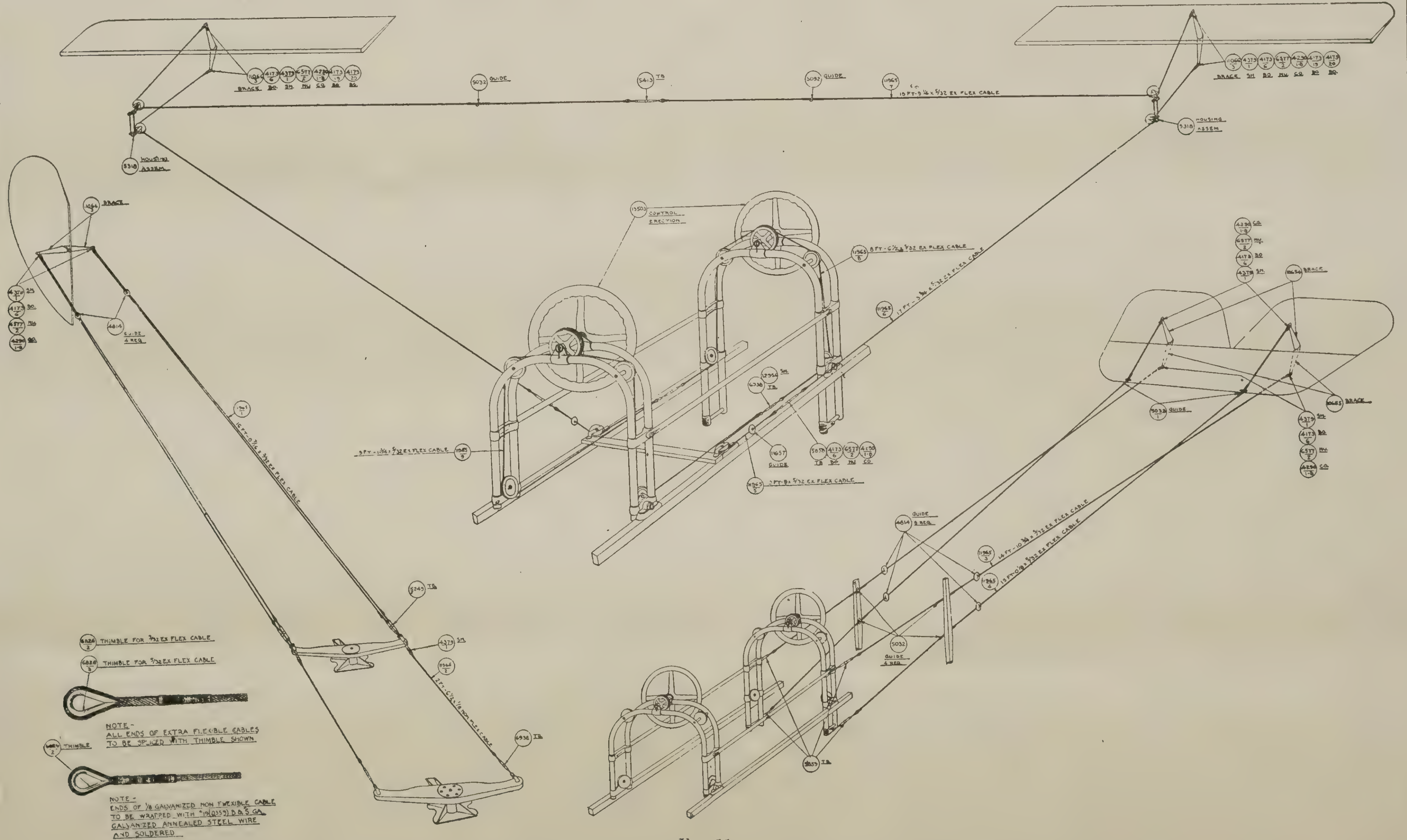

11066/3 BRACE
4173/6 DO.
4379/1 SH.
6577/2 NU
4290/1-8 CO
4173/19 DO
4173/20 DO
5032 GUIDE
5413 TB
5032 GUIDE
11965/7 15 FT-9 1/4 x 5/32 EX FLEX CABLE
11066/3 BRACE
4379/1 SH
4173/6 DO
6577/2 NU
4290/1-8 CO
4173/19 DO
4173/20 DO
5318 HOUSING ASSEM.
5318 HOUSING ASSEM
1066/3 BRACE
4379/1 SH
4173/6 DO.
6577/2 NU
4290/1-8 CO
4814 GUIDE 4 REQ.
11961/1 16 FT-0 7/16 x 5/32 EX FLEX CABLE
13503 CONTROL ERECTION
11965/8 8 FT-6 1/2 x 5/32 EX FLEX CABLE
11965/6 17 FT-3 3/4 x 5/32 EX FLEX CABLE
11965/9 5 FT-1 3/4 x 5/32 EX FLEX CABLE
12954 SH.
6938 TB.
11657 GUIDE
5058 TB
4173/6 DO
6577/2 NU
4290/1-8 CO
11965/5 3 FT-8 x 5/32 EX FLEX CABLE
4290/1-8 CO
6577/2 NU
4173/6 DO
4379/1 SH.
10654 BRACE
5032/1 GUIDE
10685 BRACE
4379/1 SH
4173/6 DO
6577/2 NU
4290/1-8 CO
4814 GUIDE 8 REQ.
11965/3 14 FT-10 3/4 x 5/32 EX FLEX CABLE
11965/4 15 FT-0 1/8 x 5/32 EX FLEX CABLE
5032 GUIDE 4 REQ.
5853 TB
5245 TB
4379 SH
11964/2 2 FT-6 1/2 x 1/8 NON FLEX CABLE
6938 TB
6826/2 THIMBLE FOR 3/32 EX FLEX CABLE
6826/3 THIMBLE FOR 5/32 EX FLEX CABLE
NOTE-
ALL ENDS OF EXTRA FLEXIBLE CABLES
TO BE SPLICED WITH THIMBLE SHOWN
6829/2 THIMBLE
NOTE-
ENDS OF 1/8 GALVANIZED NON FLEXIBLE CABLE
TO BE WRAPPED WITH #19(.0359) B & S GA.
GALVANIZED ANNEALED STEEL WIRE
AND SOLDERED

FIG. 11

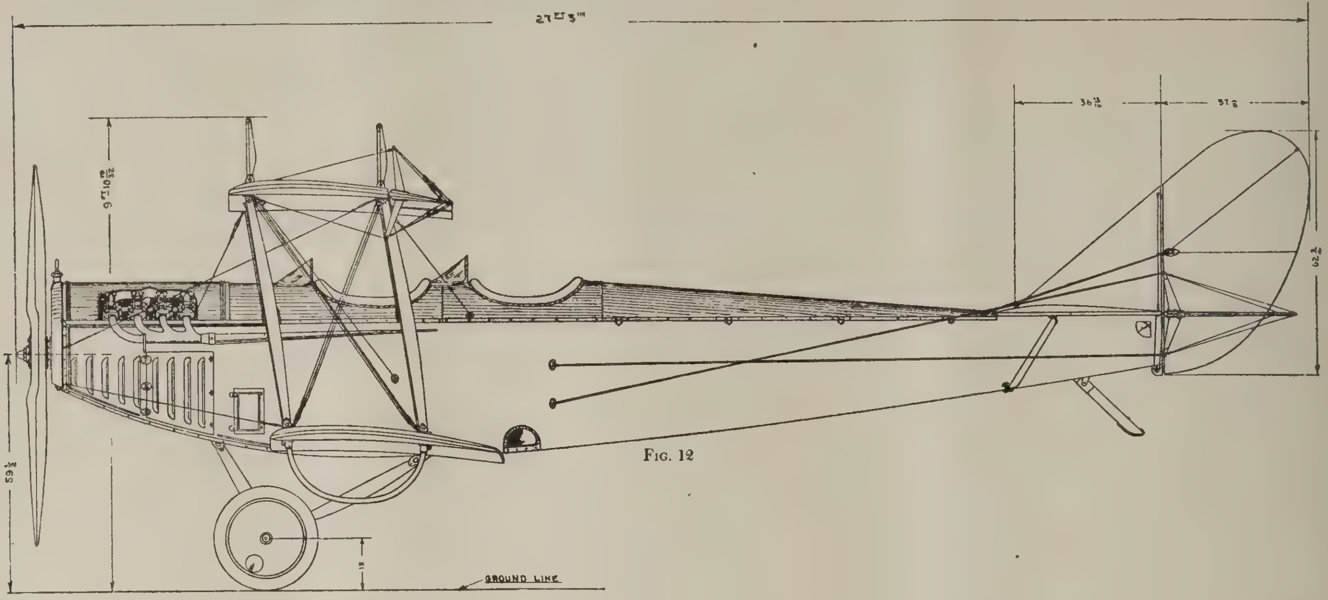


FIG. 12

(neutral position). Move the U bridge forward until the distance between the instrument board and the nearer surface of the tube of the bridge is nine (9) inches. By fixing this distance from the instrument board or dash to the back of the bridge, a slight lead is given to the control, for the greater range for raising the elevators. Now uncoil the wires leading from the clips attached to the sides of the bridge, and coiled up aft the pilot's seat. Pass the wire attached to the lower clips out through the side of the fuselage, through the lower of the two vertical holes, aft of the pilot's seat. With the bridge lashed, or fastened to the nine (9) inch position, connect this wire to the upper control brace of the elevator. Repeat operation for other side of machine.

Similarly the wire attached to upper clip on U bridge is passed through the upper hole in fuselage side, and attached to the lower control brace of the elevator. Fasten the flexible tubing fairleads (Part No. 5032-1) on the upper brace control wire to the leading edge of the horizontal stabilizer. Drawing No. 11965, Fig. No. 11, shows the general arrangement of the controls. Adjust tension in these wires, by means of turnbuckles, so that all lines have the same degree of tautness. The elevators will then be neutral for this position of the bridge.

15. General

All connections having now been made, carefully go over each shackle, pin and turnbuckle, and see that all pins are properly in place, all nuts on bolts tight, and all cotter-pinned. Try out all controls for action and freedom of movement. See that no brace wires are slack, yet not so taut that, when plucked, they "sing."

Attach nose wires leading from nose of machine to intermediate posts, front and rear. The lower wire connects up with the lower front socket, on the upper surface of the lower panel; the upper wire connects up with the upper-rear socket plate on the under side of the upper panel, after the panels are attached to fuselage, with stagger and dihedral properly corrected.

Seaplanes From Mother Ship Guard Liner.

A passenger steamship which has arrived safely at an American port, brought information that vessels were being convoyed beyond the submarine danger zone by mother ships carrying seaplanes. Passengers on the incoming steamer told of a large vessel which put out from a European port with the liner and sent off two seaplanes which took turns at hovering about the vessel for days, guarding her from U-boats.

After a stated time on duty, the seaplane on watch flew back to the mother ship, her place being taken by the other seaplane. An attack by a U-boat brought both seaplanes to the defence of the liner, passengers on the ship said.

The seaplanes dropped bombs, it was further reported, on the spot where the submarine had disappeared beneath the surface of the water. A column of water filled with small pieces of wreckage spouted up and passengers on the liner were of the opinion the submarine was destroyed.

Officers and sailors on the passenger ship refused to discuss the subject, but some of the passengers said that the submarine had fired a torpedo and that the seaplanes had dropped a bomb as reported.

Government Urged to Insure Aviators at Reasonable Rates

The National Advisory Committee for Aeronautics authorizes the following:

The National Advisory Committee for Aeronautics has addressed letters to the Secretary of War, the Navy, and the Treasury, and to the chairmen of the Senate and House Military and Naval Affairs Committees, and other Members of Congress suggesting the probable necessity or advisability of the Government undertaking at an early date the insurance of aviators, or some form of financial cooperation with the insurance companies that will enable them to write insurance at rates possible to the insured, and under conditions which will protect the companies against war losses.

This action is in a measure the result of a report submitted to this committee by the chairman of the committee of five on statistics of the Bureau of Personal Accident and Health Underwriters, wherein it was stated that it was impossible for the insurance companies to write accident insurance for aviators.

Naval Reserve Flying Corps News

Civilian citizens skilled in the flying of aircraft, or in their design, building or operation, have an opportunity to obtain a commission in the Naval Reserve Flying Corps for duty as assistant inspectors of engineering material (aviation engines and parts), flight instructors and expert aids, such as aviation motor experts, design experts and electrical experts. Those highly qualified in photography (including experimental work) may be enrolled as Chief Petty Officers or Petty Officers of the First Class. Earl Kitchener has said, "an aviator is worth an Army Corps." General Pershing has also found that an aviator is worth a cavalry division. Aviation affords the greatest opportunity for efficiency, while at the same time being thoroughly safe. A man who enrolls in this branch of the service performs a patriotic duty and is in a position to perform invaluable service to his country at this time. In addition to the regular Navy, retainer pay, one receives the same active war pay as the regular officers of the Navy Reserve, also a uniform gratuity. Apply at the Naval Reserve Office, 26 Cortlandt Street, New York City, from 9 to 5 o'clock.

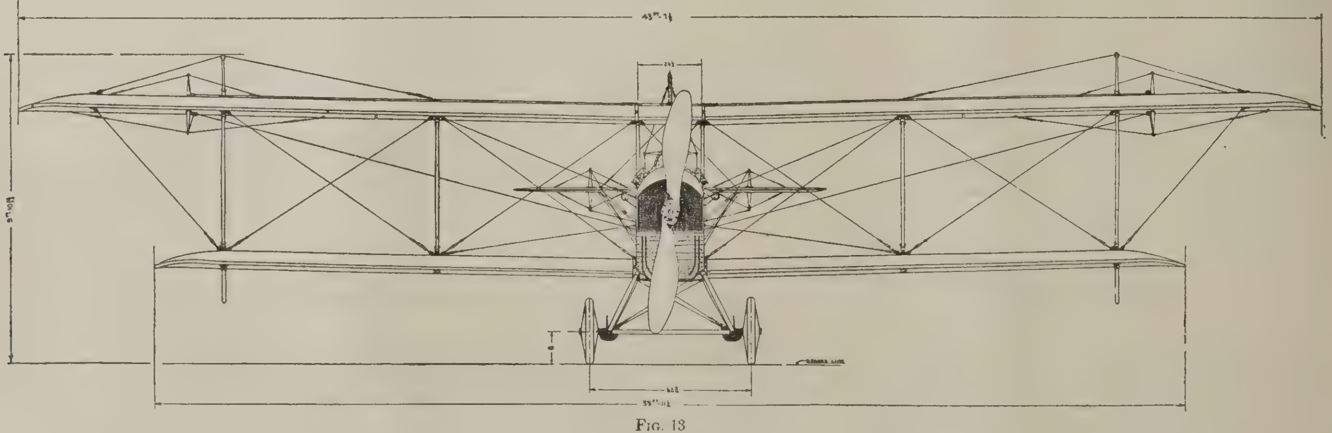


FIG. 13

National Special Aid Aviation Benefit

The Aviation Committee of the National Sp cial Aid, Chairman Mrs. William Allen Bartl announces an All Star Vaudeville Benefit fo Aviation Fund of the National Special Aid, August 31st, at 8:30 o'clock, Friday eveni under the following patronage: Mmes. Beekma French Vanderbilt, Ogden Mills, Townsend Bu den, James B. Duke, Pembroke Jones, Frederi Pearson, J. J. Wysong, Frederick Neilson, Jo Drexel, Herbert Harriman, Whitman, Stua Duncan, Wm. Grosvenor, Hugh Auchinclos Oliver Gould Jennings, Woodbury Blair, M. Van Buren, Charles Frederick Hoffman, St Wells, Hope Slater.

The program will include an address Major Perfetti of the Royal Flying Corps, A tion Commission from Italy. He will show wonderful pictures of what Italy has devel in aviation through the necessity of this Admiral Fiske will speak, and others. vaudeville side of the program is still t announced, and will include an all star cast

From the proceeds of this entertainment Aviation Committee of the National Special will donate a check to the Red Cross work Newport.

Mrs. R. Livingston Beekman has been ele the Honorary Treasurer for this entertainm Checks to be made out to the Aviation Fund the National Special Aid. Tickets $5.00 a $3.00. Newport has a National Special A Chapter and tickets may be had there or at Theatre in Newport, or Bailey's Beach, or t Casino, Army and Navy Club, in the Readin Room.

H. V. Jellicoe Guest Here

Harold Vincent Jellicoe of the Royal Flying Corps, a nephew of Admiral Jellicoe of the British Navy, is in New York, the guest of Mr. and Mrs. Charles K. Harris of 200 Riverside Drive. He met with an accident while landing in Canada, smashing his machine and spraining his ankle.

He was picked up by Vernon Castle, also of the flying corps, and was conveyed to barracks, but immediately went up in another machine to test his nerve. He is soon to leave for France.

Army and Navy Orders

The following officers will comply with the following orders:

AVIATION SECTION.

CAPTAINS.

McFarland, E. R.
Foster, P. D.
Hibbard, C. D.
Hewes, W. A.
Milburn, J. D.

FIRST LIEUTENANTS.

Raleigh, N. P.
Williams, M. N.
Wolgamot, W. R.
Matthews, C. S.
Pratt, H. L.
Ellsworth, P. F.
Powers, P. H.
Jones, E. R. L.
Smith, W. S.
McCabe, F. M.
Gomez, L. G.
Hayes, D. W.
Snyder, J. R.
Price, H. S.

Captain McFarland and First Lieutenants Jones, Williams, and Wolgamot to the Presidio of Monterey, Cal., to Signal Corps Training Camp.

Captain Hibbard to Central Department to duty.

Captains Hewes and Foster and First Lieutenants McCabe, Matthews, Gomez, Pratt, Hayes, and Ellsworth, to Fort Leavenworth Sigal Corps Training Camp.

First Lieutenants Raleigh, Snyder, Powers, and Price, to Little Silver, N. J., to Signal Training Camp.

Captain Milburn and First Lieutenant Smith, to Leon Spring, Texas, to Signal Corps Training Camp.

Captain T. Hitchcock, to Mineola, L. I., aviation school at Hazelhurst Field for duty.

Captain C. H. Teegarden will report to Chief Sig. Officer for duty in his office.

Major R. A. Milliken will report to Chief Sig. Officer for duty.

The following officers assigned to active duty, to Toronto, Canada, and report in person to Captain S. W. Fitzgerald, Junior Military Aviator, for training as equipment officers:

CAPTAINS.

Stokes, W.
Ryan, C. J.

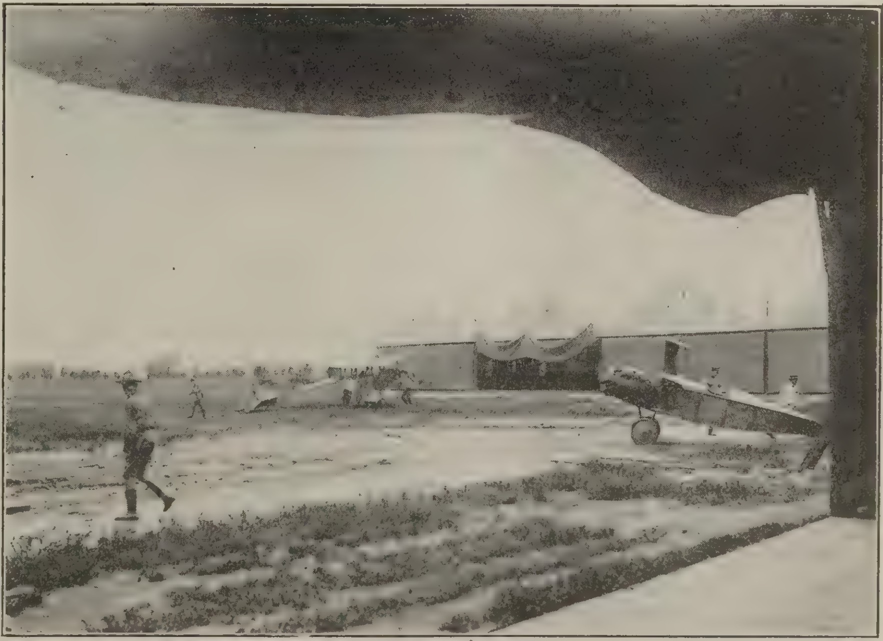
FIRST LIEUTENANTS.

Bangs, H. McC.
Egbert, L. D.
Everett, W. R.
Pierce, J. F.
Redman, E. A.
Wells, D. T.
Lochridge, R.
Briggs, J. H.
Curd, J.
Clapp, F. W.
Ellis, F. H.
Peck, H. D.
Pruden, R. C.
Sneyers, J. R.
Harris, H. F.
Smith, R. W.
Younggreen, C. C.
Brady, L. B.

Student Aviator is Killed

Dayton, Ohio—Eugene W. Hayes, a student at the Wilbur Wright aviation school, lost his balance while watching the operation of a rapidly revolving propeller on a Federal airplane and toppled over on the propeller. He died instantly. He is said to have lived in Tacoma, Wash.

Class lectures at the Gallaudet School of Aviation, with Instructor F. C. G. Eden as lecturer



A view of one of the U. S. Army training fields

L ENGINEERS

the testing the strength and properties of material and with the testing of engines generally.

In the testing of materials now commonly used in aeroplane construction, new materials will from time to time have to be tried. In addition to the testing of cables, strainers, and struts and ties, experiments will have to be made on simple and complicated steel and other plate and bolt attachments for building up the light skeleton aeroplane fuselage of wood and metal. The materials testing laboratory for aeronautical engineering students will thus become, at any rate for some years, primarily a research laboratory.

Taking timber, for example, as used in aeroplane building, it might be thought that sufficient experimental data had been accumulated regarding spruce and other woods. But this is not the case, though probably there is much more data available than has been published. Much of the requisite experimental work remains yet to be done in the determination, *inter alia,* of the effect, on the strength and elasticity of the material, of defects inherent in the natural growth of the timber.

It has been shown, for instance, that the useful strength of timber is due to that part of its morphological structure known as "mechanical tissue," and experiments have been made which seem to point to the conclusion that this tissue is actually stronger than steel, but, of course, it is diffused or spread out by other vegetable or cell structures of neglible strength. Here alone is a vast field for research. Can this mechanical tissue be concentrated into close bundles giving relatively enormous strength, and if so will the density of the material be then so high as to prohibit its use? Obviously the density, or mass per unit volume, is a factor which cannot be neglected in aeroplane work. Some woods are too heavy to be used at present. One of the author's assistants in a research carried out in the materials laboratory at the Northampton Polytechnic Institute, showed, for example, that the compressive strength of different kinds of timber was a linear function of the density—a very important result. Other properties, such as tenacity, deflection, and, in the case of struts, buckling, may also be a function of or dependent on the density. Then investigations are required on the strength and elasticity of timber, for the effects of knots and gum veins, the straightness or otherwise of the grain, the closeness of the mechanical tissues, the direction of the grain with respect to the plane of flexure. The effects of water absorbed during variable conditions of climate, *e. g.,* snow, rain or clouds, and the hygrometic state of the air on the material of the timber, have yet to be investigated.

There is further the necessity of testing plate and other attachments, by means of which the timber parts are secured together to form the skeleton structure of the fuselage, and in this connection those who have had to deal with the design and testing of these plate attachments for wood members know how very difficult it is to secure so firm a holding on such a slight wood as spruce as to stand a reasonable working stress. Here again is a valuable field for laboratory work.

Turning to another matter, a very prominent part of the laboratory equipment must consist of a wind tunnel, with its motor driven propeller and provided with indicating and recording instruments for experiments and research on models of planes and wing surfaces

flying *qua* flying, yet it will be of advantage to arrange for periodical visits of the students to the flying grounds and even to provide for some lectures given by an engineer-aviator on the behavior of aeroplanes under practical conditions of flight. In addition, as in other branches of engineering education, visits should be paid to works in which aeroplanes are in various stages of construction. In this way the student will be stimulated in his studies and will gain some insight into the every-day work of the aeronautical engineer.

It may even be found to be possible in the case of the senior students to arrange for trial flights so as to familiarize them still further with the behavior of the machines upon the theory and designing of which so much of their time will have been spent.

The case is analogous to that of the student apprentices of locomotive engineering or of marine engineering, who are always ambitious to take part in a trial run or a trial trip. Similarly, it is natural to suppose that a trial flight (not as pilot) will have attractions as well as being practically valuable for the student apprentice who is approaching the end of his college training in aeronautics.

Perhaps even the day is not far distant when the requirements of education and research will justify an experimental aerodrome, laboratory and flying ground for experiments on a larger scale and of much wider applications than is possible at the present time. The chief obstacle at the present time is the necessarily heavy expenditure.

Special and Evening Instruction

No scheme for the education of aeronautical engineers can be considered complete at the present time which fails to take into account the general as well as the specialized instruction required by the very large number of engineers and engineering students who for various reasons are quite unable to attend aeronautical courses in an engineering day college.

These men may for the most part be placed in one or other of the following classes or categories:

1. The rank and file of apprentices, learners, improvers and journeymen, the best of whom may subsequently rise to class 2, and who are employed or employable in the shops and drawing offices.

2. Trained engineers, civil, mechanical, electrical or military, who have already received in varying degrees of efficiency the educational training qualifying them for the particular branch of engineering in which they are or have been employed and who from the force of circumstances have changed over or intend changing over to aeronautical engineering. From the necessities of the case it goes without saying that, up to the present, the best design and constructive work in aeronautics has been done by men who received their technical education in one or other of the older branches of engineering before aeronautical work developed, and this training has proved invaluable to them as a solid foundation for the specialized work of aeronautics. For some time to come the ranks of the aeronautical engineer will still be recruited from men already possessing these solid qualifications, the more ambitious of whom will be eager to supplement their training and experience by special study of the new science.

For the first named or apprentice category

llent start, well calculated to arouse rest and stimulate the ambition of ho are only too much inclined to waste sure time, has been made in the series lectures which have been inaugurated ciety during the present session, and is proposed to extend in the coming nd winter. Further reference is made vork later.

t likely, however, to be overlooked substantial educational benefit is to om these lectures, regular and syscourses must be attended in a well- technical college. Such students to face much preliminary work in tics and general engineering theory, ng office and laboratory work before progress can be made by attendance ses dealing specially with aeronautical ring. Indeed, it will be found in this ion as with other branches of engineer- a very large number, probably the ma- will never effectively get beyond the mere s of workshop calculations and drawing. re called but few chosen. Aeronautical ng, like other professions, requires its s of wood and drawers of water." Nottanding, it is advisable to arrange lecture courses and practical work of an elementary character in aeronautics specially suitable to the requirements of the man who will join the artisan section of this important industry. He will be a far better workman because of a knowledge of workshop arithmetic and drawing, supplemented by simple laboratory experiments and by information gained while attending aeronautical lectures sufficient to arouse and maintain a living interest in his daily work. Some there will be who will rise through and overcome every difficulty and disability, and to these such a preliminary course of work will not only present no insurmountable obstacle, but by the facilities available will help them on their road to higher things. Such men will finally show that they are capable of successfully grappling with the higher studies requiring the more complete knowledge. A few will go beyond and raise themselves from the workman grade to that of the professional man.

The courses arranged will be progressive, the more elementary being suitable for the machine and bench hand and the higher for the leading hands, shop foremen and others.

An important question is the period of the day when such courses should be given. Up to a comparatively recent date it was assumed almost without question, that the only time available was the evening after a full day's work had been done in the commercial workshop. For those who have attained to the position of leading hand or shop foreman it is probable that this is still the only available time. But for the juniors who have only recently left school and who are yet in their teens, it is now widely recognized that such evening work involves a strain to which the majority of youths whose physical development is still immature should not be subjected and the existence of which goes far to neutralize the educational benefit which should result. For these students "time off" during working hours is absolutely necessary, and it is indeed probable that, in the near future, legislation may require that such time off shall be given. Such proposals raise social and other questions which it would be outside the limits of this paper to discuss, but, from the educational standpoint only, the definite opinion may be expressed that compulsory attendance of the juniors in engineering works at afternoon classes should lead tao valuable educational results.

At this stage it is relevant to speak more fully of the splendid work done by the Aeronautical Society and its students' section in the series of ten lectures delivered during the past six months at the Hendon centre and afterwards repeated at Cardiff. No excuse is needed for mentioning so recent a departure, for it is very probable that there are many, even members of the society, who have not realized the educational significance of this work.

The lectures at Hendon were delivered in a conveniently placed public hall to the employes in the numerous and important works and aerodromes congregated in the neighborhood. No charge was made for admission. In each case the lectures were given by well-known experts in the particular subjects dealt with, and usually a well-known member of the society presided, our worthy president being in the chair at the first meeting.

Such a series of lectures repeated throughout the country in the various industrial centers devoted to aeronautics may well be regarded as having two principal objectives, though their influence will, it is certain, be much wider. The first of these objectives is the building up of a strong students' section for the society itself. These students' sections, in more than one of the professional societies, have been a distinct success. They are essentially democratic, being organized and conducted under the aegis of the society by the students themselves. Ordinary members of the society are not allowed to attend the meetings, with the one exception that at each meeting the chair may be, and usually is, at the invitation of the students, taken by a prominent member of the society. The idea is that the meeting room should not be filled with expert critics before whom the students would be unwilling to air their original, if somewhat crude, notions. As a rule a sudent who has had special connection with a definite part of the subject is put up to read a paper. Other students diligently get up as much as they can of the subject in the time available and mercilessly criticise their colleague. The chairman acts as a moderator, and, while not sparing in his criticism, it is hoped, and, as a matter of fact, as a rule, it usually so happens that he criticises with the necessary courtesy and consideration.

The other object which the lectures at Hendon and similar lectures may be regarded as serving is the popularizing and stimulation of further study among those actually engaged in the lower ranks of the industry. Incidentally such lectures must lead to the desire on the part of the more ambitious, who, we may hope, in this industry will be the majority to systematize their knowledge by attendance at well-organized technical courses. Should this object be attained, nothing but good can result to the industry as a whole.

One need not dwell at length upon other and obvious advantages in such courses of lectures, not the least of which is the personal intermingling of so many young men with similar aims who will be the standard-bearers as well as the chiefs and captains of industry in the not very distant future. An intimate knowledge of those who are to be either directly associated with oneself or to be one's competitors is not the least effective factor in a successful career in any large industry such as that which we are considering.

Turning now to the second category for whom special educational facilities should be provided, aeronautical lectures, laboratory and drawing office classes dealing with the subject matter outlined in the syllabuses will be the first essential and will meet the requirements in many cases.

For many such students, however, still more specialized instruction in aeronautical engineering is desirable, and indeed necessary. For this purpose occasional or visiting lecturers or instructors with special qualifications should be appointed both for day and evening work. These lecturers should be intimately connected with the design and construction of aeroplanes as part of their regular daily work and should be men who have themselves received a sound and thorough technical training in the advanced as well as the more elementary fundamental principles of engineering theory. In other words, they should be highly trained on the theoretical side as well as on the practical side. Morever, an endeavor should be made to select men with a special knowledge and skill in particular branches of aeronautics, and special lecture or instruction courses should be arranged accordingly. The following are some of the subjects in which such instructors may be required for lecture and design classes.—

1. General aeronautical engineering.
2. *Fuselage* design.
3. Aero engines.
4. Aero propellers.
5. Magneto-electric ignition and other auxiliary electrical devices.
6. Meteorology and the meteorological conditions during flight.
7. The behavior of aeroplanes in the air and aircraft performance treated by an expert engineer-aviator.
8. Dirigibles and lighter-than-air machines.

The above are suggestions for consideration based on some experience, with successful results, in providing special lectures with expert instructors in specific subjects. It will be well understood, however, that the highly special work, some of which is outlined, cannot be fully taken advantage of by individual students until the elementary and the higher general engineering and aeronautical work have been fully assimilated. It has become too much the fashion in some quarters to advertise and give special lectures in aeronautics without realizing that such lectures are not likely to be of practical value until they are developed into special treatment on the drawing board, the laboratory, and the shops.

For the best results the specialized lecturer in some of the above subjects should also conduct the design or drawing office class for his special section of the work, or failing this, the class should be taken by another properly qualified designer with intimate knowledge of his subject.

Research Assistants and Scholarships

There remain two other sections of the subject to which it is important that some reference should be made, namely: (i) research and (ii) scholarships, and these may well be taken together. It has already been pointed out that much of the laboratory work in aeronautics at the technical colleges will necessarily be of the nature of research work, and in order that this work may be efficiently carried out it is essential that the ordinary teaching staffs should be strengthened by the appointment of

(a) Research assistants.

(b) The establishment of senior scholarships and research studentships.

(c) The establishment of junior scholarships.

on the lines set forth in a Report issued last year by the Committee of the Privy Council for Scientific and Industrial Research, now the Department of Scientific and Industrial Research.

These additional assistants should act under the direction of the professor or head of department, who would suggest lines of research in addition to those suggested by the assistants themselves. Suggestions for researches from other quarters such as the Aeronautical Society should also receive every consideration, and, where funds are available or can be provided, a serious effort should be made to enlist the direct interest and support of the local education authorities.

In view of the fact that the research assistant would be appointed to work at a particular college, it is recommended that as the success of the work would depend very much upon the qualifications and personality of the assistant, his selection should be made by the technical college concerned and on no account by competitive examinations. The donors of any funds for providing the research assistant would, of course, be consulted.

A suitable research assistant having been appointed, he should give his whole time to the work, but in the general interest of aeronautics it should be possible for his services to be utilized for teaching work in aeronautics for a certain number of hours during the teaching session. This arrangement would be advantageous in giving the assistant a very vital grip of the general aspects of his subject, and would be specially useful to him as well as to the teaching profession if he intended later to become a teacher of aeronautical engineering.

It is, of course, assumed that the assistant appointed would be well qualified for research work, and that he would not necessarily require any considerable proportion of the time of the head of the department, otherwise his appointment would be of doubtful value.

With respect to (b), it is as well to emphasize the difference between research which might be done by technical students and research which should be done by a research assistant, the former being of the nature of training in methods of research rather than the actual undertaking of new work, which would be the proper function of the research assistant. It is therefore desirable that, in view of the importance of their other work, senior students during the last years of an ordinary engineering course should be trained more in methods of research rather than in actual researches for publication occupying a disproportionate volume of their time.

It is also recommended that selected students who have completed an ordinary or other approved course of training should be appointed "research students" with a small maintenance allowance, less than that allotted to research assistants, the necessary funds to be provided from the same source as the funds for research assistants. In course of time this procedure may prove of material assistance in the selection of suitable research assistants.

There will be no difficulty in a fair number of subjects for research being suggested in any large engineering department, and researches may also be suggested by manufacturers. With regard, however, to the latter source of inspiration, it is recognized that engineering manufacturers in both small and large ways of business must have a number of problems from time to

PART II.—*Aeronautical Engineering.*

Hrs.	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
10.0	Theory of Machines (A)	Materials (A)	Electrical Technology (A₂)	Engineering Chemistry Lecture	Engineering Drawing	Engineering Workshop
11.0	Mathematics	Electrical Technology Exercises	Mathematics	Engineering Chemistry Laboratory		
12.0	Heat Engines (A)	Electrical Technology (A₁)	Engineering Design Lecture (B)			
2.0	Electrical Technology, Laboratory	Engineering Exercises	Engineering Exercises	Engineering Exercises	Electrical Technology, Laboratory	
3.0		Power Laboratory	Mechanics and Materials, Laboratory	Engineering Drawing		
4.0					Gymnasium	

PART III.—*Aeronautical Engineering.*

Hrs.	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
10.0	Aeronautical Drawing	Aeronautical Exercises	Graphics	Materials	Engineering Exercises	Aeronautical Laboratory
11.0		Aeronautical Lectures (Principles)		Theory of Machines	Hydraulics and Pneumatics	
12.0 to 1.0	Electrical Technology	Mathematics		Mathematics	Engineering Exercises	
2.0	Electrical Technology, Laboratory	Aeronautical Drawing	Aeronautical Design	Aeronautical Lectures (Machines)	Engineering Workshop	
3.0				Aeronautical Exercises		
4.0 to 5.0	Gymnastics			Gymnastics		

PART IV.—*Aeronautical Engineering.*

10.0	Aeronautical Drawing	Machines and Structures	Engineering Workshop	Materials	Aeronautical Drawing and Design, Laboratory	Aeronautical Laboratory
11.0		Mathematics		Mathematics		
12.0 to 1.0	Aeronautical Lectures (Engines and Propellers)	Engineering Exercises		Engineering Quantities and Estimating		
2.0	Aeronautical Exercises	Aeronautical Drawing and Design	Aeronautical Drawing and Design	Engineering Exercises	Materials Lectures or Laboratory	
3.0	Engineering Exercises			Aeronautical Lectures (Machines and Design).		
4.0 to 5.0	Gymnastics			Gymnastics		

time requiring scientific investigation, but whether these manufacturers would be willing to submit to the publicity consequent upon the acceptance of public money for the purpose of the carrying out of an investigation appears to be very doubtful. In other words, manufacturers may be expected to be willing to suggest and assist in a research provided they can reap the sole benefits of the results, but may not be so willing if it be a condition that the results are to be publicly published and placed at the disposal of their trade rivals.

With respect to (*c*), junior scholarships should be awarded to selected evening students who have, with marked success, attended evening classes or courses for, say, two or three sessions. These scholarships, with a small maintenance allowance, will permit of their holders to attend a full engineering course in the day time.

Conclusion

The above does not by any means exhaust the subject of the training of aeronautical engineers, but the authors trust that they have dealt sufficiently with the main lines to stimulate discussion and to bring this important aspect of the subject in precise form prominently before their engineering colleagues.

They hope that the next and subsequent sessions of the Universities and the technical colleges will witness a great development all over the country in the direction of providing sound instruction courses in aeronautical engineering.

If this hope be realized the time spent by the authors in the preparation of this paper will not have been spent in vain.

APPENDIX I.—SPECIAL SYLLABUSESS

I.—*General Aeronautics*—(*Principles and Machines*)

The atmosphere—properties. Air at rest and in motion. Meteorology.

Definitions and first principles.

Action of air current on plane and curved surfaces. Mass, centre of gravity, centre of pressure, lift, thrust, &c. Inertia.

Resistance to motion—wing, body and *fuselage* parts. Stream line flow.

The methods used by various experimenters to determine quantitatively the air pressures on planes and bodies. Experimental data. Illustration by smoke photographs.

Angle of incidence, aspect ratio, plan form. Flight-gliding—horizontal and oblique, flight paths. Loading, speed and power. Range of power. Climbing. Equilibrium and stability—longitudinal, lateral and directional. Automatic stability. Stability devices. The tail of elevator. Dihedral angle. Steering. Propulsion, position of screws and direction of thrust. Stability and speed.

Distribution of pressure on wing elements. Movements of the C.P. on wing sections.

Laws of similitude.

Turning, elevating or depressing, banking, rolling, pitching skidding, looping, &c.

Oscillations. Gyroscopic action. Effects of fluctuation of stresses on the structural parts. Fatigue of materials and of structural members.

Design.—The mechanical design and construction of aeroplanes. Wing surfaces and camber—forms and arrangement. Monoplanes, biplanes and multiplanes; wing warping; the *fuselage,* body, stays, struts and attachments; the under-carriage and shock absorbers. Starting and alighting devices. Boxing in and form of envelope. Skin friction. Bearings and joints. Transmission mechanisms. Controls. Instruments.

Materials of construction:—Steel, special alloys, wood, paints, varnishes, &c.

Assembling. Storage accommodation, heating, lighting, signals, &c. Cost.

Dirigibles. Seaplanes and lighter-than-air machines.

Accidents and their cause, analysis.

Applications.—Radii of action. Warfare, sport. Passenger, mail, &c. Speed and distance. Cost per ton mile. Modifications in design.

II.—*Aero-Engines*

Cycles for internal combustion engines—Otto and two stroke cycles. Advantages and disadvantages. Ideal and practical thermal efficiencies. Special considerations in designing aero engines of reasonable weight. General theoretical and practical calculations. Weight and power of engines in relation to aeroplane speed range.

Petrol, its combustion and behavior in the cylinder. Petrol storage in machines.

Arrangement of cylinder and crankshaft torque. Balancing. Vibration, periodic and variable, and dangerous stresses.

Water-cooling systems. Air cooling.

Lubricating systems. Lubricating oils and testing.

Types of aero-engine—horizontal, vertical, diagonal, or V. Radial or rotary and special considerations in design. The aero-engine of the future.

The design of special mechanisms and parts, such as cams, valves, port and pipe ways. Carburetors and carburation.

The fixing of the engine.

Ignition and electrical devices. Sequence or order of firing. Wiring and connections.

Accessibility of parts for rapid de-mantling and re-assembling. Reliability and durability in running.

III.—*Aerial Propellers.*—(*Their Theory and Design*)

Geometry of the screw and of propeller. Definitions. Air flow and forces on blade elements. Principles and formulæ. Blade shapes and sections. Various graphs for load, stresses, thrust, efficiency, horse-power, &c. Stresses due to centrifugal action and due to bending. The air screw at different speeds of translation. The propeller considered as an helicopter. Lifting effort. Effect of propeller on stability of machine with calculation on couples due to gyroscopic action. Design of propellers.

Material used in construction. "Laying out" of an air screw. Results of researches on the behavior of air screws in the laboratory and under practical conditions of flight.

APPENDIX II.—TIME TABLES

PART I.*—*Aeronautical Engineering.*

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
10.0	Mathematics	Mathematics Exercises	Mathematics Exs.	Mathematics	Engineering Drawing and Design
11.0	Mechanics* Mechanics Exercises	Physics (Optics)	Physics (Heat)	Physics (Electricity and Magnetism)	
12.0	Mechanics	Engineering Design-Lecture (A)	Physics Exercises	Mathematics and Physics Exercises	
2.0	Freehand Drawing	Physics Laboratory	Chemistry Lecture	Engineering Workshop	Physics Laboratory
3.0	Mechanics Laboratory		Chemistry Laboratory		
4.0					Gymnasium

*Each part covers a session's work.

MACHINE-GUN RANGE-TABLE FOR FLYING TARGETS

By First Lieutenant G. P. WILHELM, 4th U. S. Infantry

MODELED after the table of machine-gun fire given in the article, "New Methods of Machine-Gun Fire," printed in the October-November issue of the *Infantry Journal,* the table on p. [264] has been calculated for the Benet-Mercier machine gun.

This table, which is typewritten, with the headings in black ink and the figures in red ink, is pasted on a sheet of flexible transparent celluloid. The sheet of celluloid is then attached to the reverse side of a sketching board where it is out of the way when the board is used for sketching.

The sketching board is also made for use as a slope board with string and lead plummet on the back of the board in a groove that has been chiseled out for the purpose. The sketching board and folding tripod are carried in a canvas case, packed as a top load on a pack mule. This makes it possible to have always a sketching outfit with the company as well as a table and angle reading instrument for aeroplane fire.

The procedure of using this table is as follows:

Upon sighting an aeroplane, the Ranger Finder (Bausch and Lomb, 80-cm.) immediately begins to get the range. At the same time, by sighting over the surface of the slope board, the angle to the aeroplane is easily obtained. This sighting may be made more accurate by setting a screw eye of small diameter in the board near where the eye will sight and, at the other end, a brad. The screw eye serves as a peep sight while the brad acts as a front sight.

After obtaining the range and the angle, the table immediately gives the correct sight setting (with due allowance for 300 yards searching fire); the proper amount to turn the hand-wheel for 300 yards searching fire, and the necessary distance to aim in advance of the aeroplane. This distance is given in mils and may be obtained by using any form of mil stick; by holding the eye above the elevating mechanism, which makes the rear-sight leaf subtend approximately 100 mils—half of the sight leaf is of course 50 mils; or by using the finger system and calling one finger 50 mils. The aiming point once found approximately, this distance is fixed in the mind as a point in the air or against a cloud at the measured distance in front of the aeroplane.

RANGE-TABLE FOR MACHINE GUNS FOR USE AGAINST FLYING TARGETS. 300 YARDS SEARCHING FIRE AND FIRE OF 5 GUNS SIMULTANEOUSLY IS NECESSARY

Range in yards obtained by Bausch and Lomb range finder and elevations by slope board					(1)	Turns of hand wheel down in order to get 300 yds. searching fire (2)	Aims to be taken in mils in front of target (3)
8°	40°	50°	60°	706	80°		
800	1000	950	900	850	800	3/16	60
900	1100	1000	1000	950	850	¼	60
1000	1200	1150	1050	1000	900	⅓	65
1100	1250	1200	1100	1050	900	⅜	65
1200	1300	1250	1150	1050	950	7/16	70
1300	1400	1350	1250	1100	1000	½	70
1400	1475	1400	1350	1175	1000	½	70
1500	1550	1500	1400	1250	1050	9/16	80
1600	1600	1550	1450	1300	1100	⅝	80
2000	1800	1700	1550	1400	1200	¾	85

(1) Angles measured by bullet string and slope board. Tables pasted on board.

(2) Benet-Mercier.

(3) Calculations based on 80 miles per hour.

The table which has actually been constructed and carried on a pack mule in the machine-gun company, 4th Infantry, has never been tried out, nor are the calculations vouched for. It is asserted, however, that by use of this table the chance of bringing down an aeroplane is at least as good or better than by trusting entirely to luck and guess work.

—*Infantry Journal.*

THE WIRING OF AEROPLANE WINGS

THE ordinary set of biplane wings is trussed together by wires in its three dimensions, making it into a pure box girder, but owing to the peculiar functions of an aeroplane's wings the different wires employed serve widely different purposes.

The simplest form of biplane wing is that type found in the pusher biplane. The two main spars in the top and bottom planes form the four longitudinal members of the girder. The interplane struts form the vertical members and the compression struts which are placed between the front and rear wing spars, in line with each pair of interplane struts, form the horizontal members.

The nacelle or car of the aeroplane, which contains the main loads to be lifted, such as engine, fuel tanks, crew, etc., rests on the bottom plane, to which it is bolted, between the innermost pair of interplane struts, which are placed as closely together as convenient. The inner bay of the girder thus occupied by the nacelle is braced strongly and independently, and may be regarded as solid so far as upward and downward stresses on the main spars are concerned.

It is understood that it is the function of the wings to lift the aeroplane as a whole. Most of the weight is concentrated in the nacelle, and therefore the problem really is how to transmit the lift exerted by the wings to this portion of the aeroplane.

It will be seen from diagram No. 1, that when the machine is progressing through the air, the lift exerted on the wings will endeavor to force them upwards, while the weight in the nacelle tends to force them downwards at the center. The net result is that the wings try to fold up from the tips inwards. The bracing wires prevent his however. The upward pull of the upper spars puts these (lift) wires in tension. The lift on the lower spars puts the inter-plane struts into compression, the top spars being in compression and the lower spars in tension.

This being the case, there should be no load on the opposing diagonal wires when the machine is in the air. They come into play as the machine alights and loses its lift, and are therefore known as landing wires. With the machine resting on the ground the whole position is reversed, the landing wires being in tension and the flying wires slack. The top spars are then in tension and the bottom spars in compression. The inter-plane struts remain in compression all the time.

An aeroplane wing is not merely subjected to the reaction of lift, but also to the reaction of drift. That is to say, the pressure of the air on the machine as it travels through the air reacts in a horizontal sense and tries to fold the wings backwards as well as upwards. Here the horizontal bracing comes into play. The wires (known as drift wires) prevent the rear spar from bending backwards, and the compression struts hold the front spar at the correct distance. The opposing diagonal wires (known as anti-drift wires) take the strain when the machine is subjected to a sudden loss of forward way, as for example when landing on rough ground.

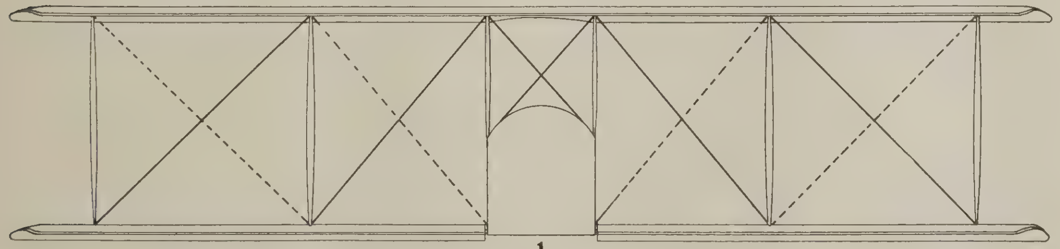
The spars are also subjected to a bending moment between each pair of supports, which is at its maximum at the centre point between the supports and runs progressively to zero at the actual points of support.

Many aeroplanes are also fitted with external drift wires running to some point at the front of the machine, and external anti-drift wires running to the rear.

The third dimensional bracing serves to hold the upper and lower planes parallel to one another and in correct relation to the rest of the machine. The change of centre of pressure on the wing curve modifies the relative loads placed on each member of a pair of these wires, which are known as incidence wires.

It should be clearly understood that the strains imposed on the different wires described are merely those of normal flight. Under peculiar circumstances, both in the air and on the ground, the spars, struts and wires may be called upon to resist strains of a much more complicated nature, so that adequate strength must be given to each member.

For instance, certain lightly loaded, powerful machines fly at a slightly negative angle when travelling absolutely at full speed. This in itself places loads in strange places, but when the machine is in the intermediate stage and performs the curious operation of "hunting," further complications ensue which must be guarded against. The study of the manners and customs of the different tension and compression members in an aeroplane's wings cannot receive too close attention.—W. L. W., in "The Aeroplane."



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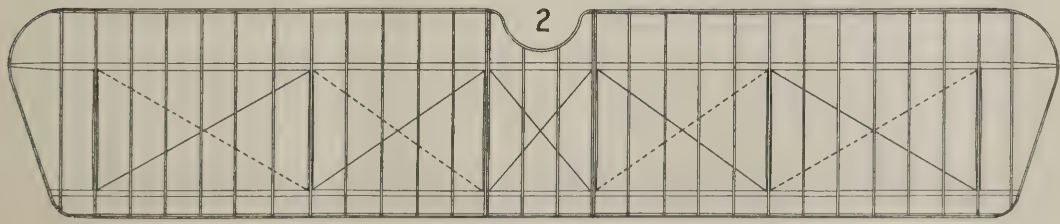

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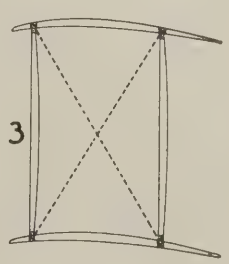


3

Lines marked thus:
--------indicate—
1- Lift wires,
2- Drift wires,
3- Incidence wires.

H. and M. FARMAN FIGHTING AEROPLANES

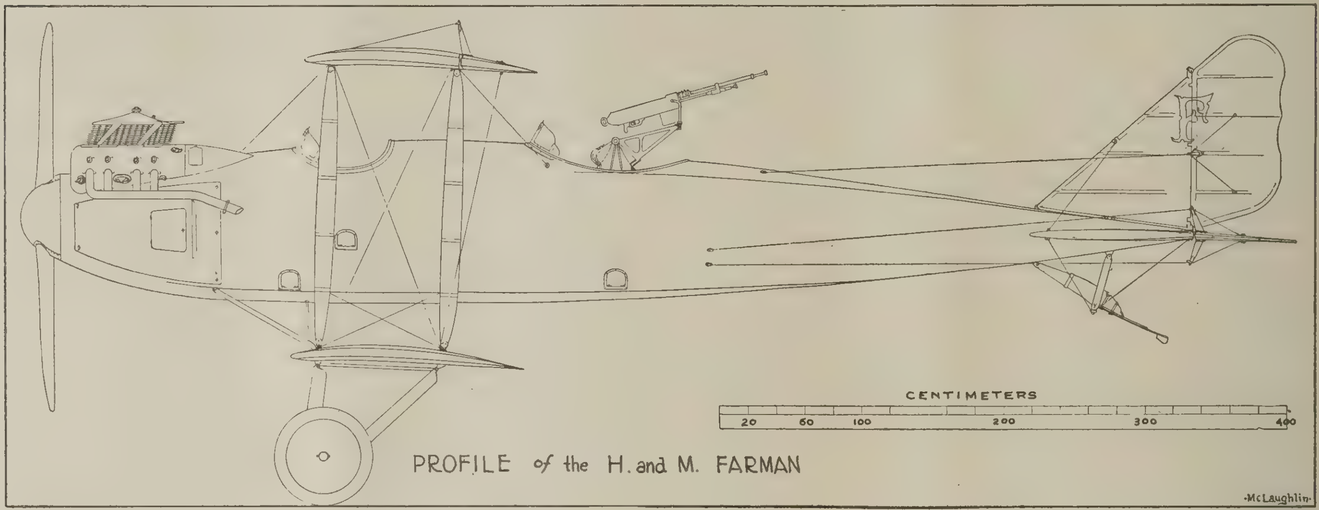
THE aeroplane factory of Henri and Maurice Farman, located at Billancourt (Seine), is said to be producing machines of various types at the rate of ten every day. The factory is two miles long, and with its extensive facilities and a force of 5,000 employees, the Farman establishment produces all parts of the aeroplane at the Billancourt factory, including all the woodwork and metal parts. A type of machine differing from those illustrated here has recently been constructed, and for which a speed of over 250 kilometers an hour is claimed. This is equipped with a well-known 220 h.p. Farman-built rotary motor.

In the "Type F" fighting machine, two designs are represented. Besides these, Farman has developed reconnaissance and bomb-dropping aeroplanes with 160 and 220 h.p. motors.

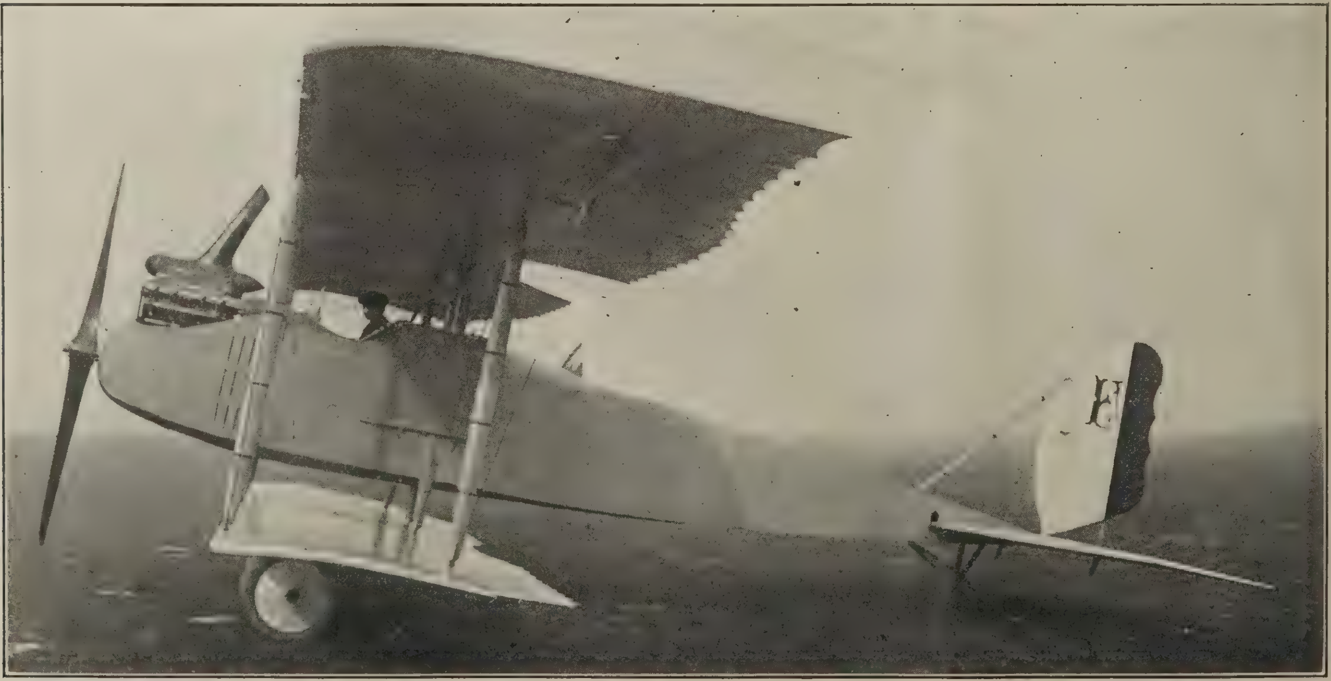
The "Type F" fighting aeroplane is equipped with a 160 h.p. motor, and has a high speed of 175 kilometers an hour. We reproduce here a photograph together with a line drawing showing the plan and side view of this machine. It differs from the other fighting type in having a balanced rudder, exhaust above the motor and extending above the plane, and radiators flanking the sides of the fuselage. Its net weight is 760 kilograms and it is capable of carrying a load of 440 kilograms. The instruments and equipment include a Hotchkiss machine gun, wireless set and bomb-dropping apparatus. With its full load the machine can attain an altitude of 2,000 meters in 8 minutes. The machine is finely balanced, and handles easily on the ground and in flight.

One of the other types, not shown in the drawings, has a net weight of 760 kilos and carries a useful load of 600 kilos. It has a 220 h.p. motor, develops a speed of 200 kilometers an hour and climbs 2,000 meters the first 6 minutes.

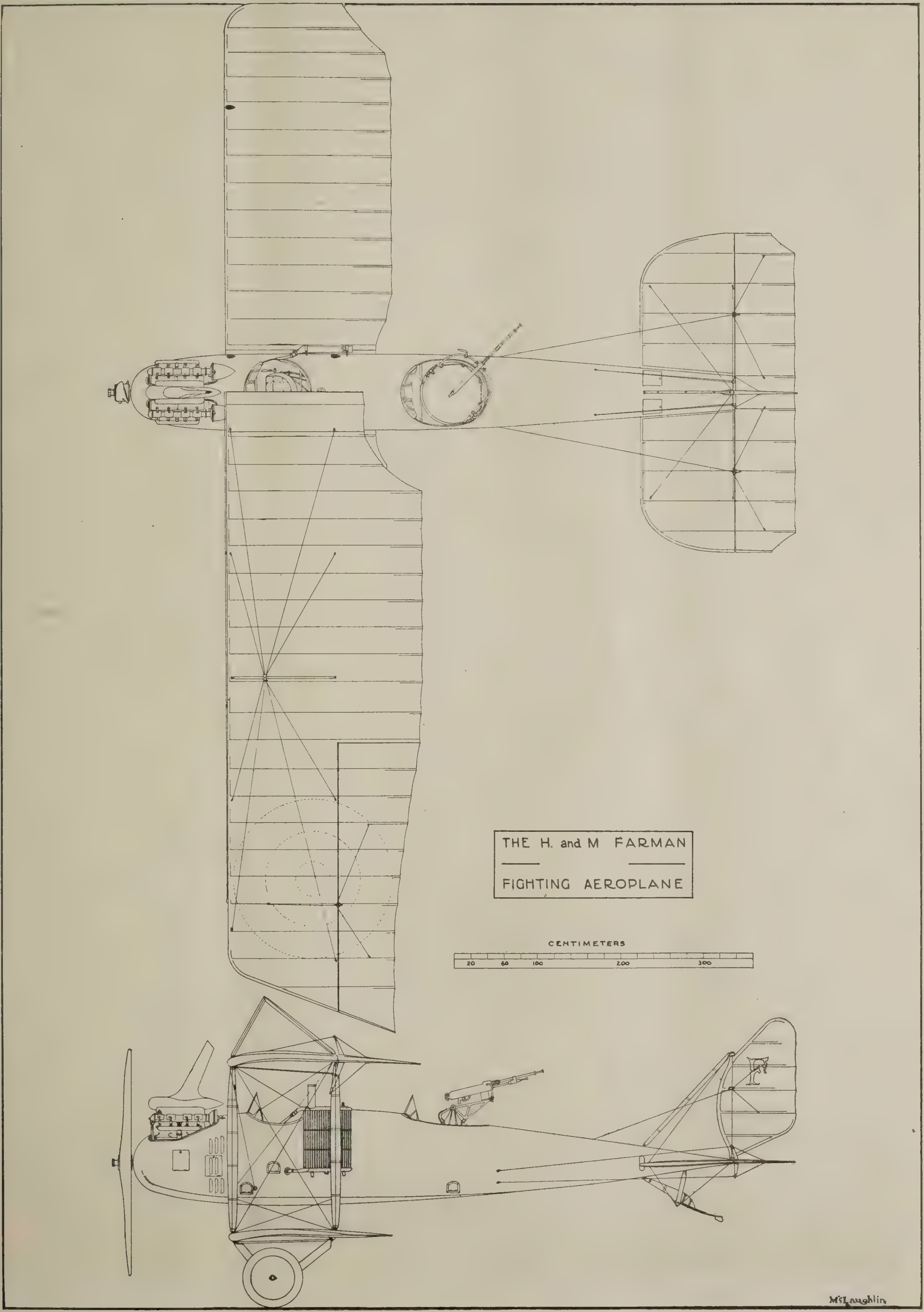
The bomb-dropping machines have a net weight of 900 kilos and a useful load capacity of 700 kilos. They are equipped with 220 h.p. motors. Their speed is 190 kilometers an hour and their climb in 6 minutes is 2,000 meters. Machines of this type are capable of remaining aloft for a duration of ten hours.



In 1907 Henri Farman, an automobile racer, like his brothers Richard and Maurice, in the automobile business, became interested in aeronautics. He practiced gliding, and in January of 1907 decided to build an apparatus propelled by a motor, which was finished in September, and with which he made many experiments at Issy. Four months later Farman won the Deutsch-Archdeacon prize of £2,000. He then gave exhibitions in Belgium and this country. Every one of his flights was really an experiment and he was constantly making constructive changes, until today the result of his early work is represented in the well-known organization at Billancourt.



Side view of the Farman Fighting Aeroplane, illustrated by the drawings on the opposite page



THE H. and M FARMAN

FIGHTING AEROPLANE

A ROTARY SHAPING MACHINE FOR PROPELLERS

IT was in watching the operations with ordinary joiner's chisel and gouge, draw-knife and spoke-shave, says *Flight,* that the inventor of the Rotary Shaping Machine was struck with the tediousness of the whole process, and was seized with the idea of introducing power for both the removal of the waste in bulk and the final shaping of propellers for aircraft.

Owing to the difficulty of working an aircraft propeller by machine, the shaping has hitherto been largely done by hand, and in order to have any chance of success the inventor saw that the machine would be required to impart the sensitiveness of the pressure of the human hand. This led him to think of a mobile rotary cutter, somewhat similar in principle to the hairdresser's rotary brush.

By reference to Fig. 1, it will be seen that the apparatus consists of a rotary cutter which revolves in a casing, handles being provided for holding and directing the tool, and the power being connected (through the handle at one end) in the shape of an electric motor, or through a flexible shaft to a pulley driven from the line-shaft. The tool used is of the milling cutter type, about 3 inches in diameter by 4 inches in length having about 12 teeth, which operate with a shear cut, the shear being arranged to drive the chippings obliquely in the direction of an outlet in the casing provided for the purpose. The casing is made of gun-metal and steel, as light as practicable. The opening seen in the casing is for the projection of the cutters, and it can be varied by means of the adjustable shutter or slide seen immediately above, this adjustment being required for regulating the depth of cut. The shutter is secured to the casing in side guides or slots. The outlet for the ejectment of the chippings is best seen in Fig. 2. It is funnel shaped, and arranged so that the chippings are delivered to the right-hand side of the operator, and away from the driving shaft or motor. The cutter spindle is carried in self-aligning double-row radial-type ball bearings, the inner and outer races of which are secured in position by lock nuts. The cutter is easily removed from the machine by slackening two clamping screws, withdrawing the handles and spindle, and raising the adjustable slide. The ease with which this is done will be clearly seen by reference to Fig. 1.

Where electric current is available, undoubtedly the best drive is obtained by direct coupling a small high-speed motor, in the manner shown in Fig. 2, the motor being balanced as shown in the line drawing, Fig. 4. This arrangement is very efficient and workable, and eliminates the greater part of the wrist work experienced with the flexible shaft drive. The machine is connected to either motor or flexible shaft by means of a socket with bayonet joint, and a flexible coupling and spline shaft connect the spindle of either the motor or flexible shaft to the driving spindle of the cutter. If electrically driven, the motor can be run off any lighting supply.

The machine itself weighs about 12 lbs., exclusive of the motor or flexible shaft, but it is found quite unnecessary to balance this weight, as the latter provides just the steadying necessary and prevents all inclination to jumping as the tool performs the operation of cutting. The balancing arrangements shown in Figs. 4 and 5 are solely to take the weight of the motor or flexible shaft. In the case of the motor drive, the balancing arrangement, with its counterweight, is carried on a gantry rail, the length of the latter being to suit half the length of the longest propeller to be worked. A motor running about 3,750 revs. per minute, and giving ½ b.h.p. continuously and 1 h.p. for short periods, is found ample to drive the machine, and the weight of such a motor is about 25 or 26 lbs.

In the flexible shaft drive (see Figs. 3 and 5), the shaft, which is about 10 ft. in length, is connected to a driving pulley running in ball bearings and supported on a stand, the bearings being arranged to swivel to give additional range to the flexible shaft. The pulley is 3½ inches diameter by 2¼ inches face, and runs at about 3,750 to 4,000 revs. per minute.

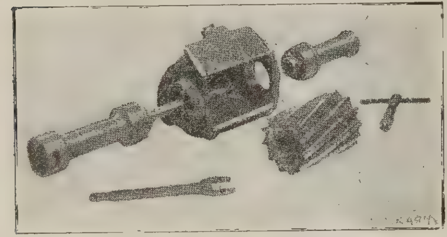


Fig. 1. The parts of the apparatus dissembled

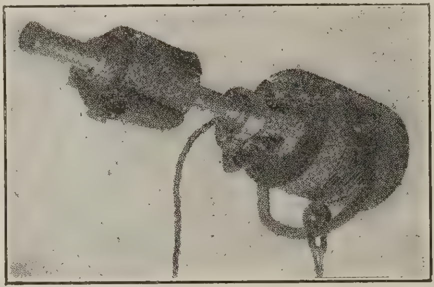


Fig. 2. Motor drive. The funnel seen on top of the tool casing is for the ejectment of chippings

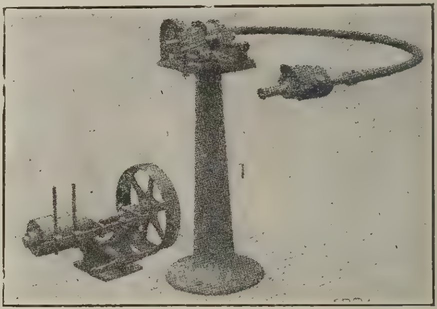


Fig. 3. The Flexible shaft drive. Emery wheel for sharpening cutter mounted on standard

On an extension of the spindle which carries the driving pulley an emery wheel is mounted for sharpening the cutter, a hinged tool carrier or bar being bolted on to an extension of the pulley bracket and having a fine screw adjustment. The cutter is moved to and fro on the bar against an adjustable stop.

For sanding, the cutter may be replaced by a drum covered with sandpaper, but the tendency is to obtain a second machine for this purpose, as it is found in practice an advantage to have a larger casing for sanding.

The apparatus will rough out a two-bladed propeller in about two hours; the same work, we understand, takes about one day by hand labor.

The propeller is bolted to a low trestle or stand, enabling the operator to sit astride the work. A gauging table should be provided at the right-hand side, which should be suitably marked for guiding the operator to obtain the shape required.

As to how far the tool can be used for finishing the propeller depends upon the dexterity of the operator, but as a roughing-out tool it is no doubt a considerable acquisition in any aircraft factory.

Its use is not, of course, in any way confined to aircraft work, and its adaptability is almost as extensive as the joiner's spoke-shave on irregular work, especially for furniture requirements in shipbuilding, railway rolling stock construction, school and institute furniture manufacture, etc. It is also useful for flat planing floors, decks, etc. We understand that arrangements have now been made for Messrs. Thomas Robinson and Son to manufacture and market the Rotary Shaping Machine. Applications for further particulars should be sent to this firm.

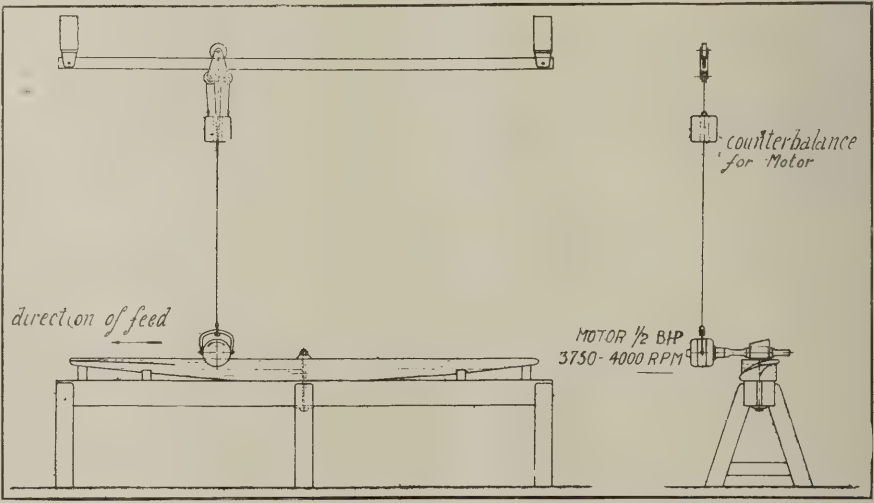


Fig. 4. Showing direct motor drive arrangement

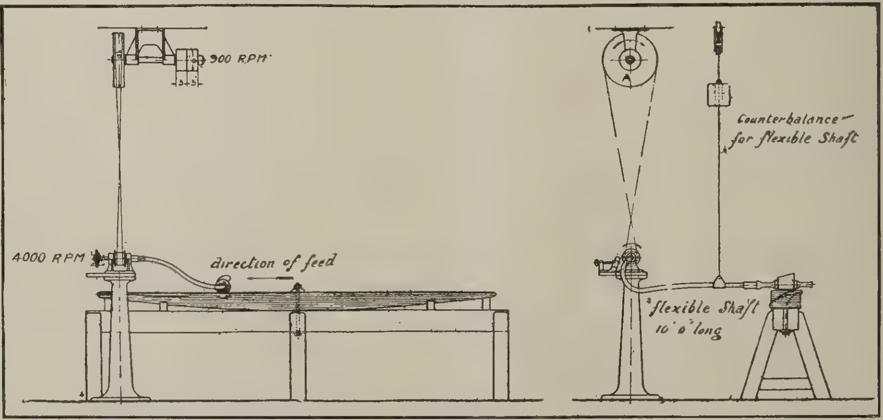
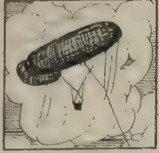
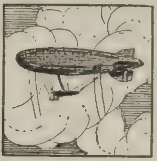


Fig. 5. Showing the Flexible Shaft Drive Arrangement.—The countershaft, A, must be placed directly over the centre of the stand and drive by cross-belt as shown. Belt 1½ ins. wide



MILITARY AEROSTATICS



Airship Suspension Systems

(*Continued from page* 834)

The excessively long girder car is now also gradually falling into desuetude, and most externally rigged non-rigid airships now have quite a short car suspended from a rigging band, with the addition of trajectory bands in the case of Parseval airships.

The United States S. S. Type

The United States S. S. type airships adopt the rigging band, but have what appears to be a defect in the actual arrangement of the guys. There are five rigging guys on each side of the car, and of these all except those at the bow and stern are dropped perpendicularly from the envelope (Fig. 2). This ship is climbing, which could easily be remedied by crossing guys B and D as in Fig. 3. Similarly, the center guys (C) should be crossed transversely as seen in end elevation, to prevent the tendency of the car to roll. The importance of both these points is emphasized in a patent (No. 15,872) taken out by C. Maiche in 1912.

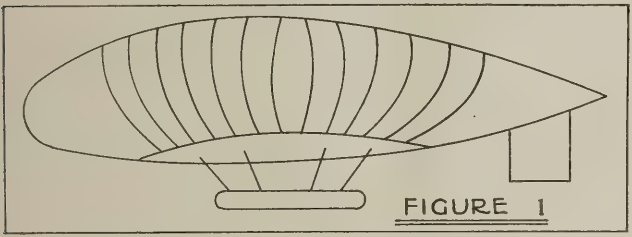


FIGURE 1

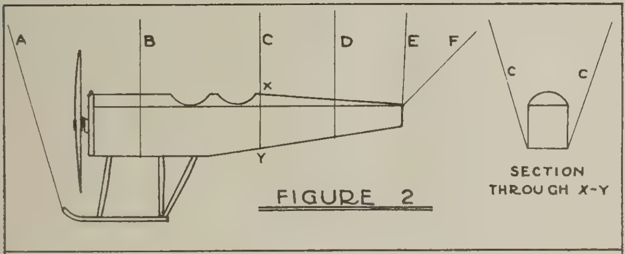


FIGURE 2

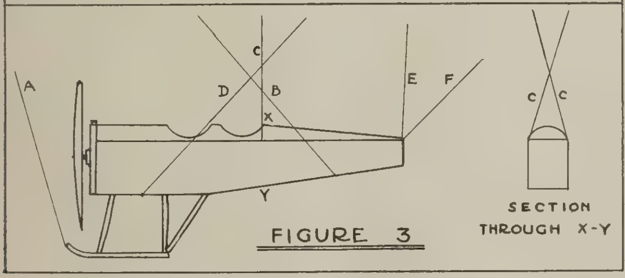


FIGURE 3

Internal Rigging Systems—The Torrés-Quevédo Type

External rigging has the disadvantage of enormously increasing head resistance, and several attempts have been made to devise a satisfactory system of car suspension in which the suspensions are for the greater part inside the envelope. The best known of these is that invented by M. Torrés-Quevédo, a Spanish engineer, in 1907 (British Patent No. 15,938), and exploited commercially by the French Astra Company, the British rights being vested in Messrs. Airships, Ltd. In this system an envelope of trefoil shape in cross-section is used, formed by inscribing a semicircle on each side of an equilateral triangle, the semicircles forming the envelope, while the sides of the triangle are fabric curtains joining the junctions of the lobes, and serving to maintain the shape of the airship. Along each of the folds formed by the junction between the top and side lobes cables are inserted, to which are attached fabric suspension strips. At frequent intervals along these strips suspension ropes formed of bundles of cords are attached. The suspension ropes from both sides meet near the bottom of the envelope, and are continued in a cable which comes out through the bottom of the envelope at the junction of the two bottom lobes. There are four such cables, from which the car is slung, a set of the suspension ropes being taken to each. Fig. 4 gives a diagrammatic sketch of the system.

The Forlanini Type

The Italian engineer Forlanini has devised a non-rigid airship (described in British Patent No. 19,898 of 1914), in which the keel is enclosed in the outer cover of the envelope, and the suspensions are internal. The envelope comprises an outer cover and an internal gasbag, with an air space between the two, so following the practice in rigid airships. The internal gasbag is fitted with a number of longitudinal diaphragms radiating from the longitudinal axis of the balloon and from the junction of the diaphragms a triangular steel tube keel is suspended by wire ropes, the car being attached to this keel. The envelope is also divided longitudinally into compartments by transverse bulkheads of fabric to prevent "surging" of the gas. A digrammatic cross-sectional view is given in Fig. 5.

The Verduzio Type

The Verduzio airship (British Patent No. 11,922 of 1914), which is also an Italian design, is similar to the Forlanini, in that both employ a keel, but the internal suspension system is more reminiscent of the Torrés-Quevédo than of the Forlanini.

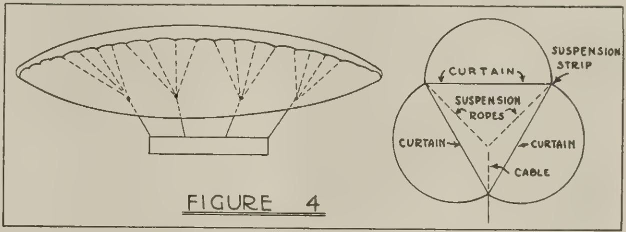


FIGURE 4

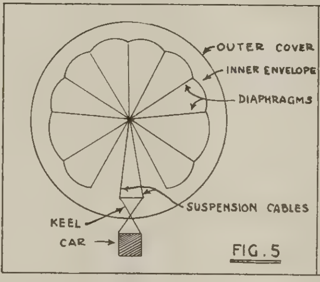


FIG. 5

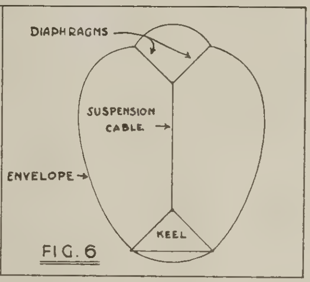


FIG. 6

The envelope is almost circular in cross-section, but has a small top lobe, to the junctions of which are attached fabric diaphragms which meet near the top of the envelope, instead of at the bottom as in the Torrés. To the point where these diaphragms or curtains join the suspension cords are attached, from which a triangular keel is suspended (Fig. 6).

It will be noticed that in all the three systems of internal rigging systems described the weight is taken on the top surface of the envelope, which has various disadvantages arising out of that mentioned earlier in this article. As has already been pointed out, a non-rigid airship is entirely dependent on the pressure of the gas for the maintenance of rigidity, so that if the pressure falls below a certain point (usually about 15 to 20 millimetres of water) deformation will take place. Now in an airship where the weight of the car is borne by the bottom surface of the envelope the effect of loss of pressure will merely be—at any rate, in mild cases—that the envelope will lose its circular shape in cross-section and will tend to become oval, a feature which will not be followed by very serious consequences. In the case of an internally rigged ship, such as the Astra-Torrés, however, the envelope is unable to adjust itself to the changed conditions in this way and some other deformation must take place. The bulk of the weight being taken by the midships portion of the envelope, it is obvious that relief will take place at the ends, which will tend to rise. The effect of this will be that the airship will "break its back" and become completely unmanageable, while at the same time a considerable extra strain will be put on the forward and after guys, which will either carry away or pull through the bottom of the envelope. In the Italian systems, where a keel is provided along practically the whole length of the envelope, this disadvantage is not fraught with such serious consequences.

Within the limits of this article it has been impossible to do more than give a general sketch of the different suspension systems employed in airship design, and no attempt has been made to go into the details of any of the different methods. Such details as have been given should, however, suffice to convey a tolerably accurate impression of the general principles of the more important types of airship which have proved successful in service, and perhaps lead the reader to indulge in further research; for which purpose the references to the patent specifications covering the different inventions may prove useful.

FOREIGN NEWS

DENMARK

Copenhagen.—Allied aviators recently dropped bombs on the bathing place of Homburg while the German Emperor was staying there, according to a traveler who has arrived here from Germany. The traveler, who was at Frankfort-on-the-Main when it was attacked by French aeroplanes three weeks ago, says it was reported there that the same aviators had dropped the bombs on Homburg. One of the Emperor's two headquarters is said to be in Homburg.

The traveler says that the first bomb dropped on Frankfort destroyed a number of houses.

FRANCE

American Field Headquarters.—Kermit Roosevelt, now a captain in the Canadian army, was a visitor at the training camp of the American contingent on August 14. Young Roosevelt is enroute to Mesopotamia. He saw the Americans go through their various war practice stunts.

Throughout yesterday a sharp lookout was kept for aeroplanes. This followed the sounding of an alarm from headquarters on Sunday, when every one in camp and in the town nearby rushed into the streets gazing into the sky in search of the hostile aircraft believed to be approaching.

Paris.—Sergeant Paul Pavelka of Madison, Conn., a former member of the Lafayette squadron, who for eight months has been flying with a fighting French squadron in Serbia, has been honored with a glowing citation in an order of the Army of the Orient and decorated with the French war cross with one palm.

The citation, signed by General Sarrail, was read to the French, British, Russian, Italian, and Serbian armies fighting on the Salonica front. Pavelka was praised for his activity and devotion. Recently he has had more than a score of air duels and on several occasions has driven his opponents to the earth.

Corporal James Ralph Doolittle of New York, a member of the Lafayette squadron, has been cited in French army orders and awarded the war cross for courage in attacking and driving away a German aeroplane which attempted to destroy a British observation balloon. He has recovered from injuries received in the combat and has returned to the front.

On the day of August 17 and the night of August 17-18 French bombardment squadrons carried out numerous expeditions over the enemy lines. One hundred and eleven aeroplanes took part in the various sorties in the course of which 13,000 kilograms (28,600 pounds) of projectiles was thrown on enemy establishments. Two French machines did not return.

Aviation grounds at Colmar, Frescati and Habisheim; aviation camps in the region of Chambley, railway stations at Fribourg-en-Brisgau, Longuyon, Montmedy, Pierrepont, St. Justin, Grand Pre, Challerange and Dun-sur-Meuse and encampments in the Forest of Spincourt were showered with bombs. Many explosions and several fires were observed.

On the night of August 16-17 the railway station at Cortemark was attacked by French aviators, who saw a large fire there.

Yesterday seven German aeroplanes and a captive balloon were brought down by French pilots. Eight other enemy machines were forced to land in the German lines badly damaged.

From a section of the French front comes word that the renowned aviator, Captain George Guynemer, brought down two more German machines, making fifty-two he has accounted for. Guynemer visited headquarters to receive a decoration from a distinguished Rumanian General.

Paris, Aug. 19.—Corporal Harold Willis of Boston, a member of the Lafayette Escadrille, has not returned from the raid of Friday which resulted in a number of fights with German aviators. Hope is still held out, however, that he will come back.

The Americans were divided into two groups, one commanded by Lieut. Lufbery of Wallingford, Conn., the other by Adjutant Didier Masson of San Francisco. Dudley Hill of Peekskill, N. Y., had a narrow escape when two Germans attacked him with incendiary bullets. He escaped, however, with one bullet hole through a lower plane by outmaneouvring his opponents. He is believed to have brought down one German.

W. A. Courtney Campbell jr. of Kenilworth, Ill., who two months ago lost one whole wing of his machine in midair and yet managed to return to his own lines safely, was again the victim of a peculiar accident. Just as the bombing party reached the home field a heavy bombing machine balked and landed squarely on top of his chasing machine. He saw the danger in time and scrambled out to safety. His plane was cut squarely in two.

GERMANY

On Aug. 12, an Entente aeroplane passed over Frankfort-on-the-Main and dropped several bombs in the crowded streets. Four persons were killed and several others were wounded.

On the previous day Frankfort was raided by a number of Entente airmen, who dropped several bombs. No one was killed. A few inmates of a hospital were injured slightly. One of the aviators dropped five bombs in a wood to the west of Frankfort without causing any damage.

An official statement issued by the French War Department said that two French aviators flew to Frankfort-on-the-Main on Aug. 11 and dropped bombs on the city. The statement added that the raid was made in retaliation for the German bombardment of Nancy and the region north of Paris.

Berlin.—During July the Entent Allies lost 213 areoplanes and thirty-four captive balloons, according to an official statement from the War Office to-day. The Germans lost sixty aeroplanes and no captive balloons. The statement follows:

"During the month of July the losses of our adversaries amounted thirty-four captive balloons and at least 213 aeroplanes, of which ninety-eight were brought down in flames, as the result of aerial attacks behind our lines and 115 beyond the enemy lines. We lost sixty aeroplanes and no captive balloons."

Berlin.—An official statement issued on Aug 13 says:

"One of our aviation squadrons yesterday attacked England. Bombs were dropped with visibly good results on the military works at Southbend and Margate, at the mouth of the Thames. One of our aeroplanes is missing.

GREAT BRITAIN

London.—It was officially stated that the German air raid on Aug. 12 marked another victory for the aerial defenses of London, which undoubtedly was the objective of the plane squadron.

At the first intimation of the enemy's approach British aeroplanes rose at once from all points, climbing at daring angles. The result was that the German attackers found waiting for them a home air force more than sufficient to prevent them from reaching their goal.

Earlier in the day the fact was made public that two of the raiding aircraft were brought down, one off the Flanders and one off the Belgian coast. The evening statement said:

"The reports of our pilots show conclusively that the enemy aircraft formation which attacked the eastern countries was making for London. On sighting the large number of our aeroplanes which were sent up against them they turned abruptly and made their way out to sea again, dropping some bombs on Southend and unloading the rest when out at sea.

"The action of our anti-aircraft guns was of great assistance to our fighting squadrons."

of Aug. 13, when a British pilot met three planes at a height of 11,000 feet and engaged them all.

The four pilots brought their machine guns into play and the conflict raged furiously for some time. The British aviator fought on despite the great odds against him. By clever manoeuvring he reached a position which enabled him to pump a stream of bullets through the tanks of two enemy machines. The third German fled on seeing his companions brought down.

London—The Admiralty announces the successful carrying out on August 16 of a series of raids by aviators of the Royal Naavl Air Service, who dropped many tons of bombs on military objectives in Belgium. The Ostend railway station and sidings and the Thourout railway junction were attacked.

The airdrome at Ghistelles was bombed and several fires were observed. Attacks from the air were made on the airdomes at Engel and Uytkerke. All the aeroplanes returned safely.

American citizens serving in the British army can be transferred to the American army provided the transfer will be to the advantage of the United States. This suggests that there will be greater freedom than ever before in the matter of transfers. It is probable that the new order will provide the American army training on this side of the Atlantic with several thousand seasoned soldiers.

Many will wish to make the exchange for the sake of the promotion that is likely to follow. For a private who has seen a year or more of service with the British will be worthy of being made at least a corporal in the new American army while an efficient sergeant is likely to get a commission. The fact that this transfer opportunity is given at the present time suggests the soundness of the British army.

A total of 114 German aeroplanes have been brought down during the week of Aug. 13 in fierce sky fighting that has been in progress in connection with the allied offensive.

Sixty-two of these enemy machines were destroyed outright and fifty-two were driven down out of control.

The aerial operations were carried out despite unfavorable weather, and were marked by extreme daring.

A check up showed forty British machines missing following the week's fighting.

The Prussian fliers took great chances in their efforts to communicate artillery ranges back of their lines. It was learned they were under orders to get the ranges or die in the attempt.

HOLLAND

Amsterdam.—A German aeroplane with two occupants landed Aug. 12th at Oostburg, a Dutch town near the Belgian border 15 miles northeast of Bruges. The occupants of the machine were interned.

Sas Van Gent.—Terrific explosions of bombs dropped by Entente Allied airmen in a raid shortly before midnight on Aug. 18, on Selzaete, a Belgian town on the Dutch frontier, eighteen miles north of Ghent, awakened all the inhabitants of this town. German anti-aircraft batteries were very active, some of their shrapnel bursting over the Sas Van Gent.

Ghent, which in normal times has a population of 170,000, also was raided by the Entente Allied aviators.

ITALY

On the afternoon of Aug. 16, one of the Italian flights effectively bombed the enemy encampments and military assembly centres of Comen. All the Italian aeroplanes returned safely to their bases.

Four tons of Austrian bombs were dropped on historic Venice early on the morning of Aug. 14, killing four persons and wounding twenty-seven others. Vienna announces that the raid was carried out in retaliation for Italian bombing flights above Pola, the Austrian naval base, with the Venetian maritime arsenal as an objective; but two of the dead and twenty-one of the injured were patients in a hospital which was wrecked by the projectiles.

The hostile aviators were met by the fire of destroyers and defending 'planes, and, according to Austrian admission, three of the raiding machines were destroyed.

The official account of the raid from Vienna suggests a naval as well as an air engagement. The Italian torpedo unit is said to have retreated before the Austrian covering flotilla. It is admitted, however, that this flotilla received a number of Italian bombs and that Parenzo, an Austrian seaport, from which the Austrian craft presumably operated, was also bombed.

Austrian sky squadrons have raided Venice several times in the past, and the authorities have removed many of the valuable paintings and protected most of the historic monuments with unique sandbag armor. Several severe fires are reported to have been caused by the present visitation.

Air activity along the whole Italian front has been extraordinary for the last fortnight, leading to the belief that General Cadorna intended to initiate another drive either on the Carso Plateau or east of the Isonzo River.

MODEL NEWS

Edited by G. A. Cavanagh

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Mr. Travers Ayers' Ornithopters

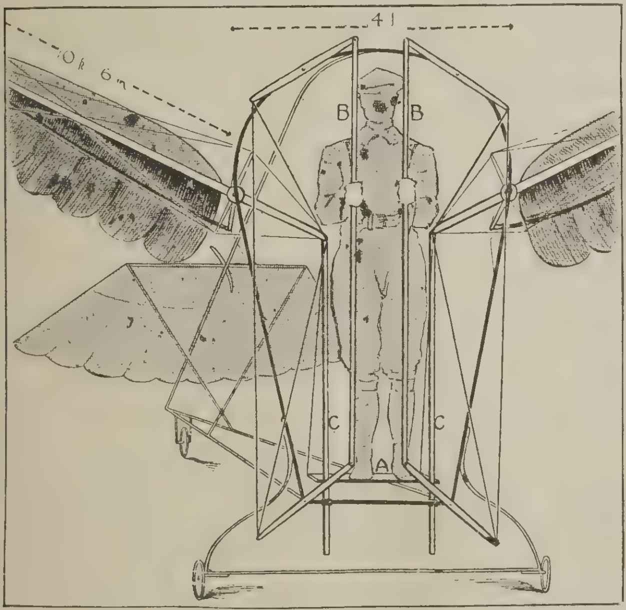
An Interesting Study for Model Flyers

(*Concluded from page* 836)

The wing-arms work on a pivot attached to the saddle, which in turn is strapped to the pilot's back. The pilot then holds the arms, PB, and proceeds to run along the ground, flapping the while.

This has actually been tried on Tooting Common with the following results:—Firstly, elastic was placed upon the hooks, AA, and connected to king post, C, and when running along the ground the air pressure on the under surface of the wings, coupled with the elastic, made it extremely difficult to lower them. The elastic was then removed, the result being considerably better. Again, the elastic was attached to the arms, BB, connected to the belt, D, giving decidedly the best results.

It has never been tried from a slope, but only from the level, thus it was not under the best advantages; *nevertheless a distinct flap of the wings was often obtained when off the ground.* In actual flight the bird then only uses power on the down stroke.



Here They Are!!

Three of America's foremost model aeroplane constructors now supervising and building large machines for the Lawson Aircraft Company, of Greenbay, Wisconsin. Reading from left to right: Frank Schober, member of the Aero Science Club credited with being one of the most exact and neatest constructors in the East. Just before leaving for the West Frank completed a series of experiments with compressed air motors which are familiar to Eastern flyers. Not so long ago one of his biplane models equipped with a compressed air engine was credited with flying over 200 feet. Harry Grolich is seated in his miniature automobile. As may be noted, he built this machine along lines of simplicity and neatness, a good example of his ability. When Harry was associated with the New York Model Aero Club he was known to have made models along the same lines as his recent production. As to F. John Caresi? Enough said. Every young fellow in the civinity of New York City who has had anything to do with models knows John. John was present when the art of model flying was introduced to the New York boys way back in 1907-8. Many of his models are reproduced in early model books and it is safe to say he thoroughly understands the construction of aeroplanes and engines. An example of his workmanship is represented in a machine known as the A. B. C. Anyone who has seen the machine can appreciate John Caresi's ability.

Three noted model aeroplane builders. Left to right: Frank Shober, Harry Grolish, and John Caresi

Duplicative Motive Power for Models

The rubber motors (assuming rubber to be used) should be enclosed in light streamline bodies, assuming four propellers to be employed; or two of them could be enclosed in the double *fuselage*. These *fuselages* could be paralled or nearly so. In the case of more than two propellers only one extra motor container need be used, and in the case of four propellers only two extra need be used. Such models are, of course, innovations, and innovations, at any rate in open model competitions, have not always been received with that favor which one might have expected.

At the present time there are those that consider that two motors in a full-sized machine are really no better than one, if as good, and that the machine of the future must carry more than two, in all probability not less than four motors, with possibly four propellers, or it may be two, suitably geared; all of which goes to show that the problem of the multi-motored model is one which should not be neglected. Of course, it is more difficult and far more troublesome in many ways than the red single or twin-propelled model. It is a problem which probably only an enthusiast would care to tackle. The initial failures are likely to be great and many, but when once success of only a moderate character, say, had been obtained there would be created an entirely new type of model, with boundless possibilities before it.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Dawn Patrol

'Tis dawn; and the night mists are rolling
Away from the face of the earth;
The squadron is up and patrolling,
To greet the new day at its birth.

The sun is arising serenely,
'Tis flooding the country with light;
The wind in our faces blows keenly,
And sleep flies away with the night.

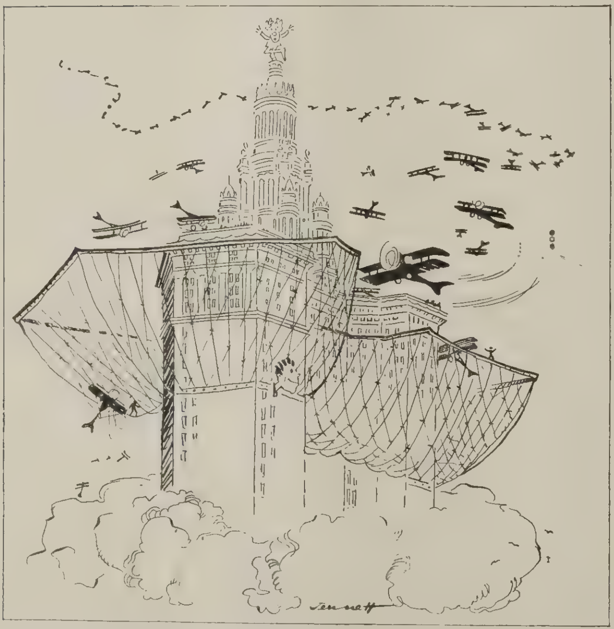
High, high in the heavens suspended,
We fly in the world of our dreams,
And wide 'neath our feet is extended
A landscape that different seems.

Here, touched by the sunlight's bright finger,
All golden the sea is ablaze;
While there, where the night mists still linger,
Deep purples and greys meet our gaze.

The silvery linings are showing
Of clouds that to earth appear black;
'Tis only the clouds know our going,
The eagle alone knows our track.

The finger of fancy to guide us,
Detached and aloof and alone,
The rest of the squadron beside us,
We fly in a world of our own.

The sunlight displaces obscurity,
Thus spelling an end to our quest,
We turn to the golden futurity
And sweep to the welcoming west.



It was not so long ago that we had the pleasure of reproducing a clever idea, the property of the celebrated Irish inventer Pat Pending. As you will remember the idea concerned the landing of aeroplanes on buildings in large cities and in that case the roof of the building settled upon the aeroplane to prevent its falling off the other end. Pat's new idea, as reprinted herewith, is still better in so far as it enables the aviator to land upon the roof without the slightest fear of falling off the other end. Should the speed of the aeroplane prevent its landing within safe limits it merely rolls off the edge and lands in the net, as illustrated, a very simple matter.

Pat hints of a still better idea but we won't tell just what it is

Baron Munchausen and J. Verne Please Write

London, July 24 (by Mail).—The *Pall Mall Gazette* is responsible for this:

Flying low over the German lines, a British aviator was soon in the midst of a whining swarm of German bullets. The Germans in the trenches were firing straight up, hoping to pierce his gasoline tank.

The aviator—a cool youngster—looked down, saw a bullet slowly ascend the last few feet of its maximum height. It stopped dead still for the smallest fraction of a second.

The aviator reached quickly, grabbed the bullet and put it in his pocket.

Reflections of a Proud "Terra Firma" Lovr

By Bumm Steer

I saw the blade of his tractor flash,
And the glance of his knowing eye,
And I knew that he thought he was cutting a dash,
As his plane went flying by.

And he may loop in a speedy Spad,
Or steadily sail o'er the heath;
And dream that he looks extremely bored
To the people who watch beneath.

But he shall think, when the night is still,
Of smashes in gathering numbers,
And the ghost of many a doctor's bill
Shall hover around his slumbers.

The worn out engine shall worry his sleep,
And creditors cluster around him,
And he shall creep from the fuselage deep,
Where their spectre-eyes have found him.

Ay! grasp your wheel and warp your wing
And bid your "bus" go faster;
It does not know as it soars aloft
That it has a fool for a master.

And hurry away on your speedy flight,
Nor deign from the ground to take me;
I will walk along slowly, out of your sight,
With the two legs Nature gave me.

—Bumm Steer.

Here lies a lad who had plenty of nerve,
But forgot what to do as he banked on a curve.

Things are so quiet in a bowling alley that you can hear a pin drop.

Many a man's conscience is like cold treacle; it moves slowly and gets there too late.

The man with a scheme is not looking out for your interest; it's your principal he is after.

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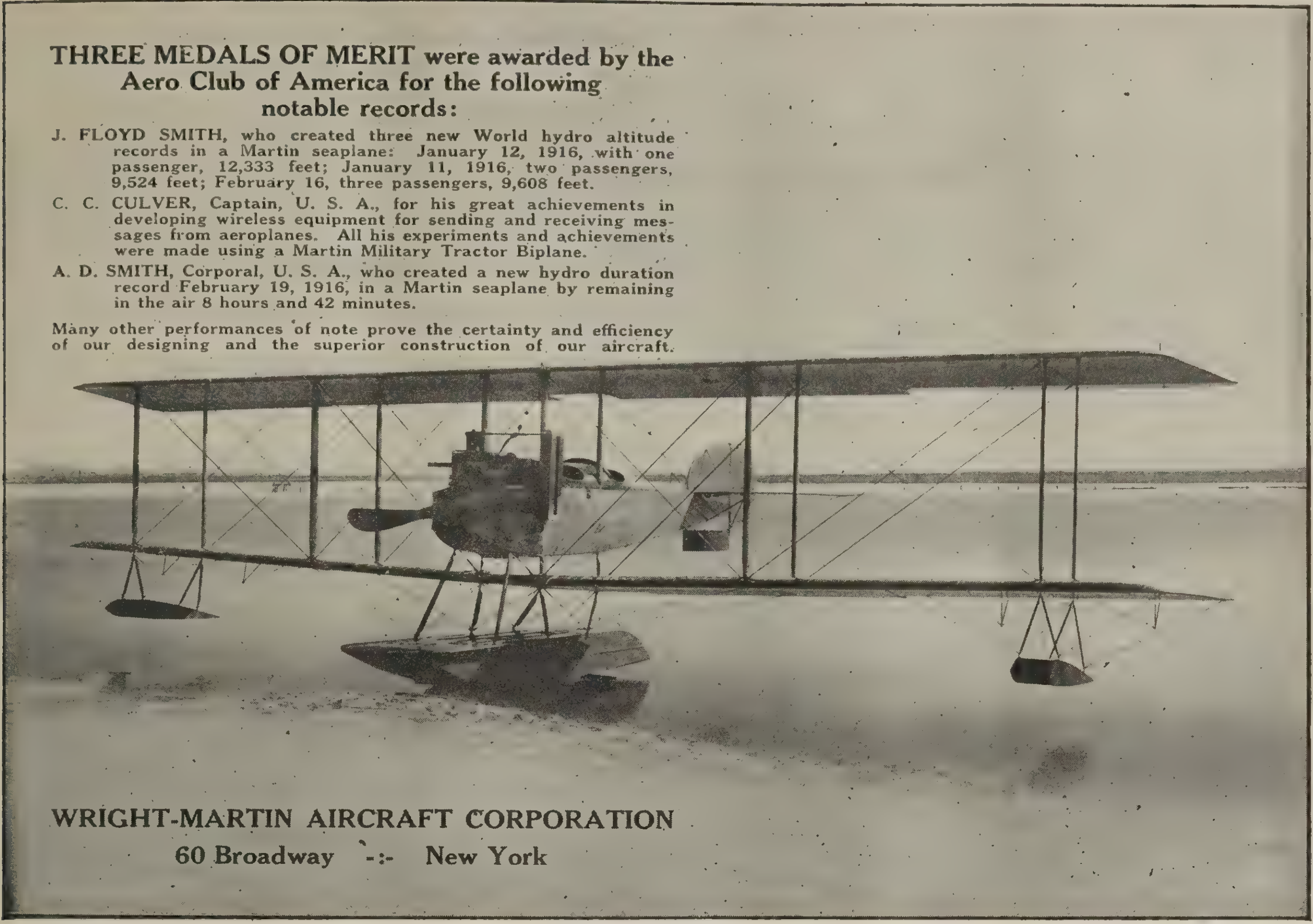

THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

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C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

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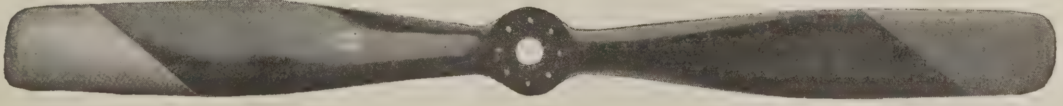

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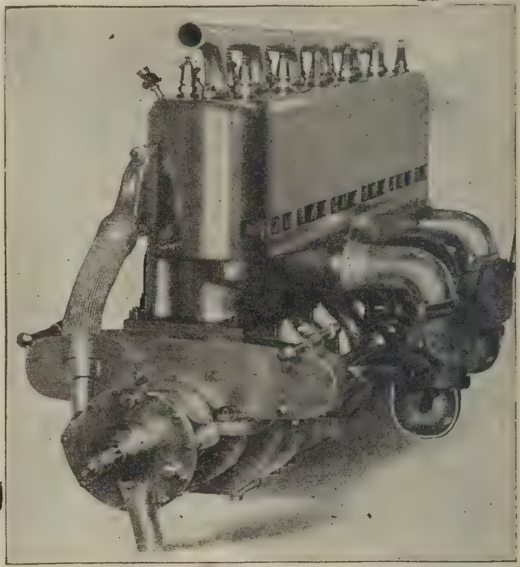

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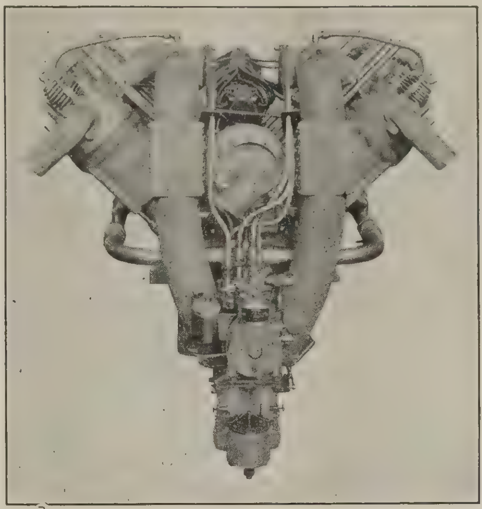

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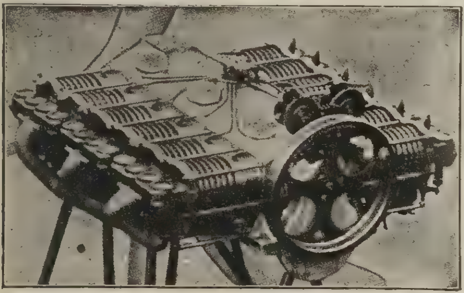

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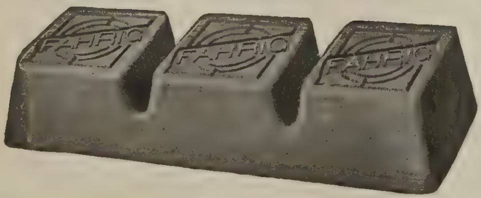

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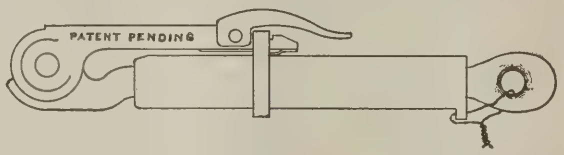

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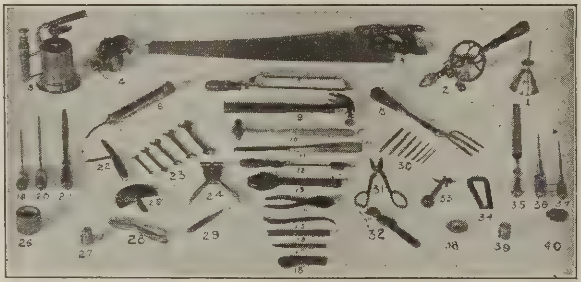

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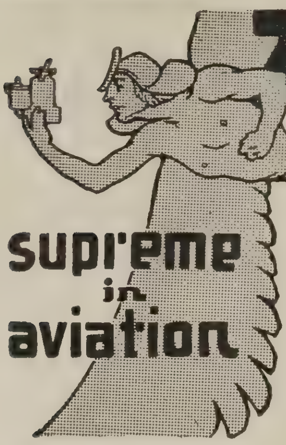

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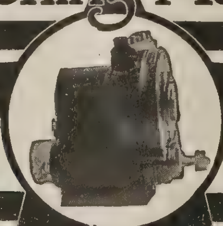

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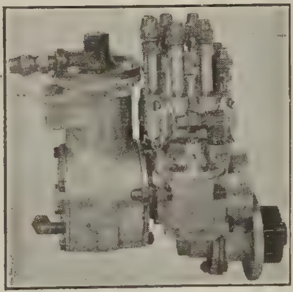

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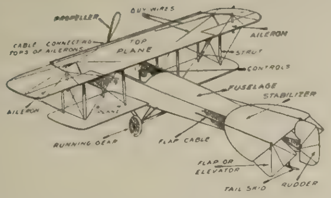

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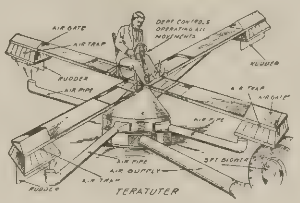

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WEEKLY

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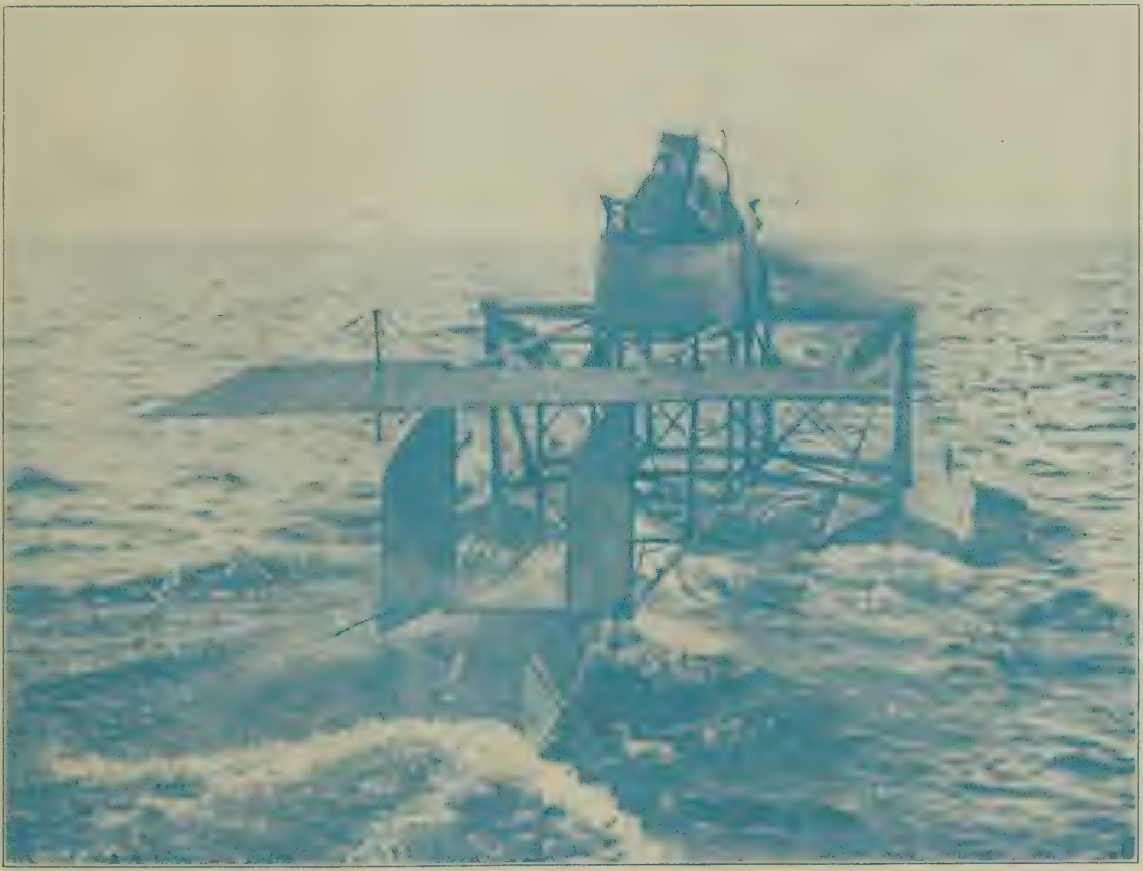

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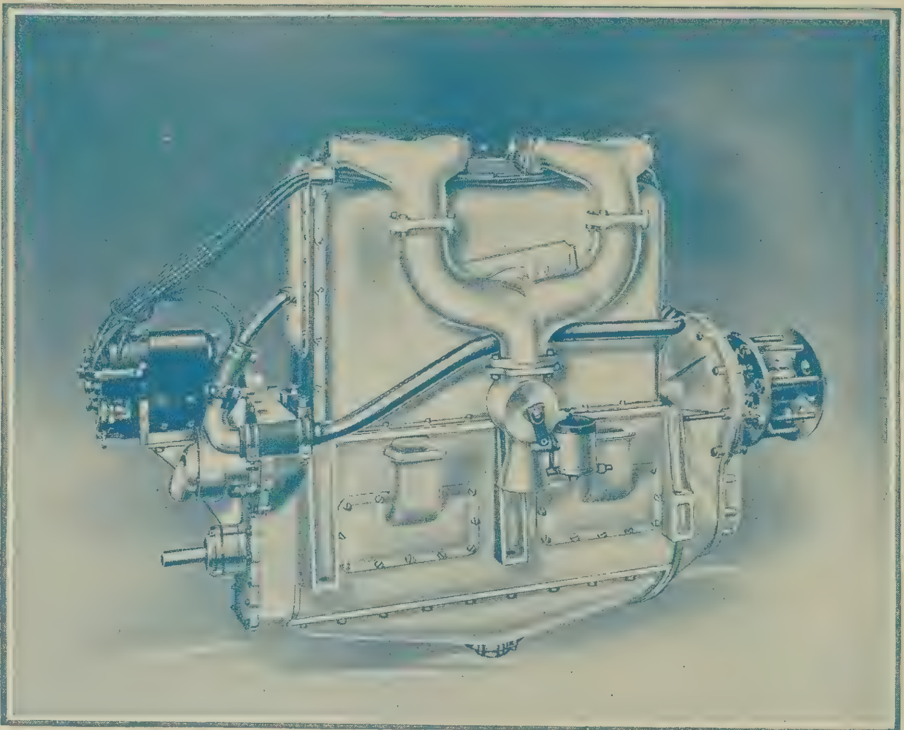

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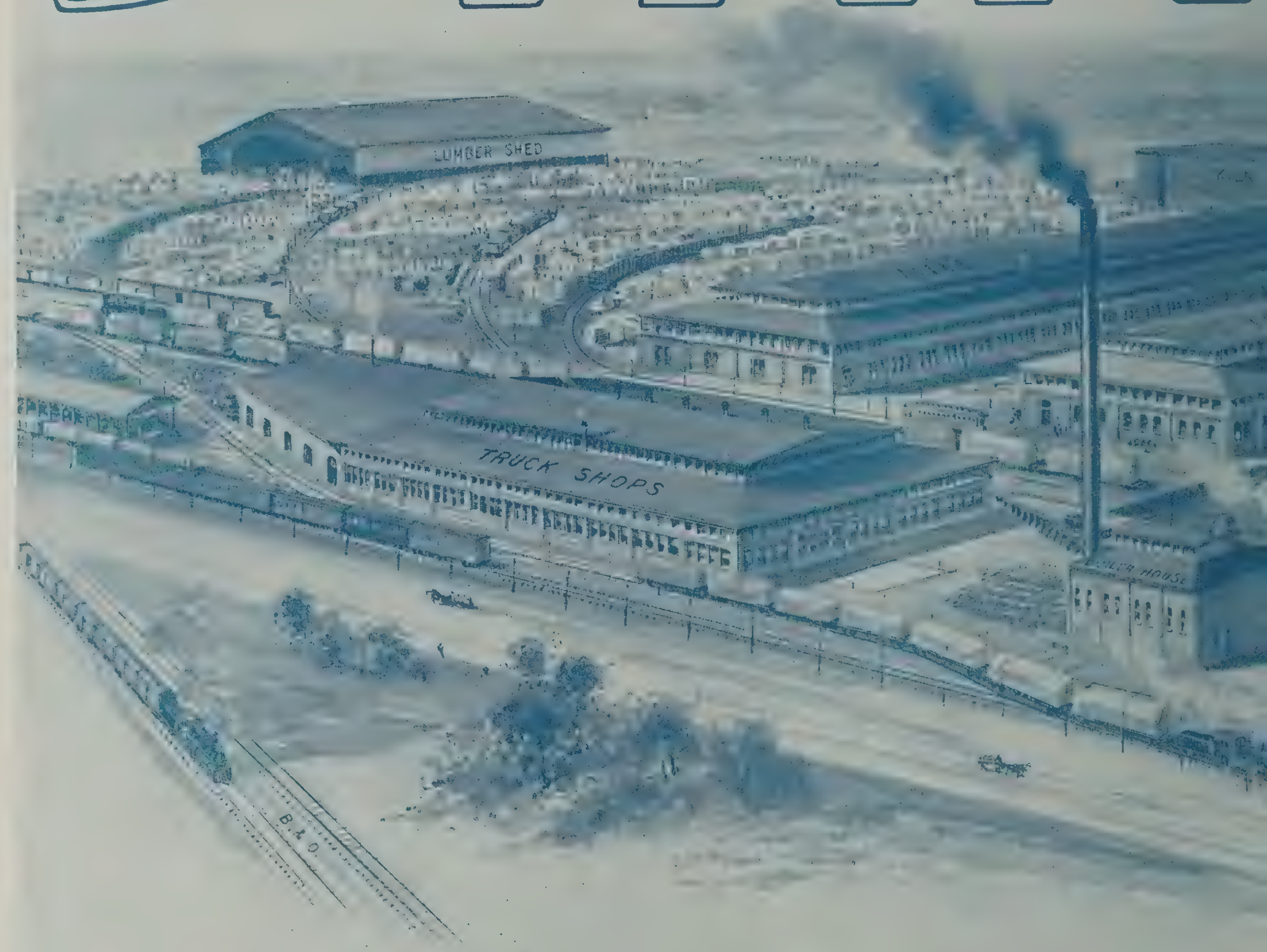

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First: They are lighter in weight.

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Third: Their wonderful strength and resiliency are best evidenced by their ability to absorb shock and prevent rebound in landing and getting away.

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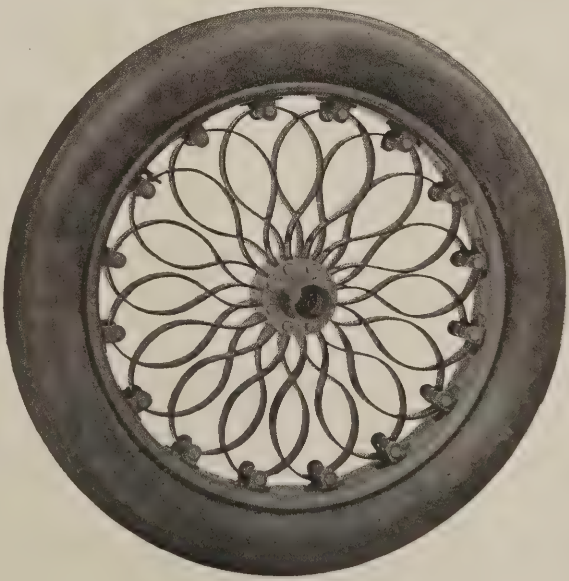

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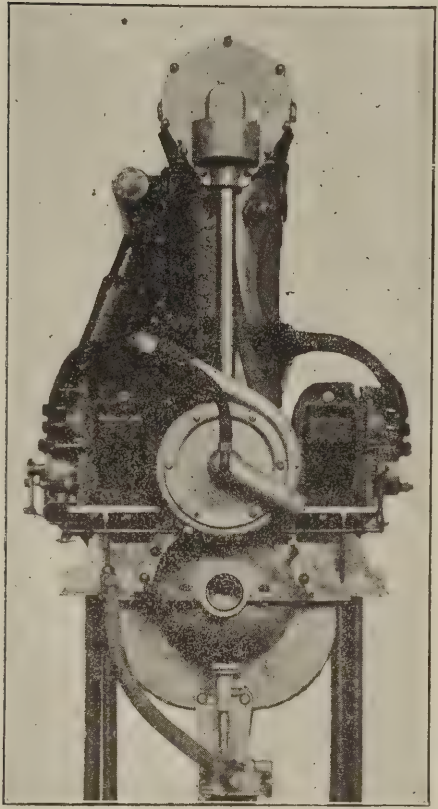

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The refinements of keel construction, steadying side fins, and stabilizing tail-cups are Goodyear contributions to steadiness in air.

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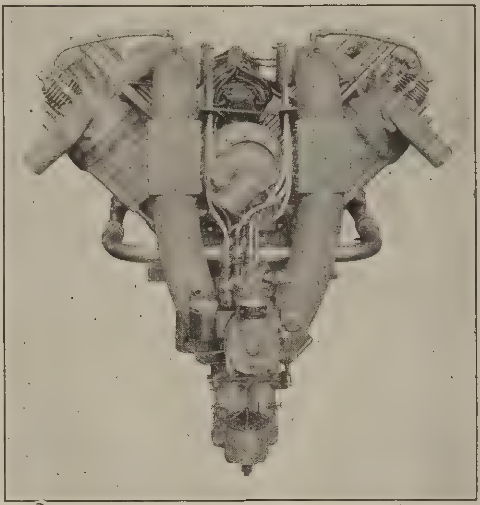

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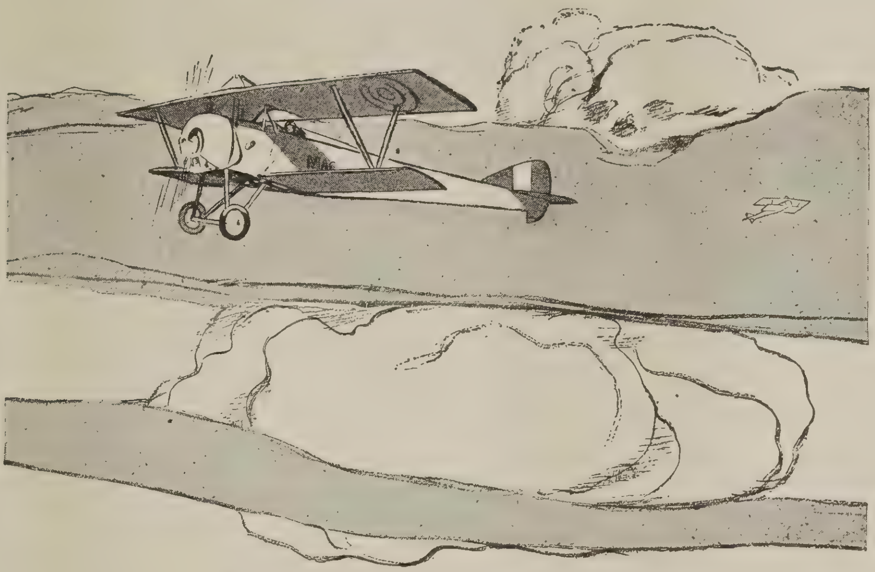

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VOL. V NEW YORK, SEPTEMBER 3, 1917 No. 25

BILLION DOLLARS ASKED FOR AERO MOTOR PURCHASES

RECENT tests of the new United States' aeroplane motor, the result of the combined activity of a body of the leading internal combustion engineers, have been so consistently satisfactory that a new appropriation, probably of $1,000,000,000, will be asked by the first of November, it is expected. The necessity for this is evident when it is taken into consideration that of the $640,000,000 recently appropriated only half was for actual construction, the rest being for field equipment, schools and personnel.

A half dozen of the higher class automobile factories of the United States, which will assume the chief burden in the manufacture of the motors, are ready to go ahead with the work. Some of the smaller plants will supply parts and accessories.

With a standardized type of motor it will be possible for the officials in charge of aircraft production to procure the engines to almost any number desired practically from the start of manufacture. The plants which will turn out the motors have been for the most part supplied with the necessary equipment. They are awaiting the results of one or two final tests.

There is of course great secrecy as to the details of the new motor, but officials admit that it exceeds their expectations. No problem will arise, they say, in getting the motors speedily and in any quantity desired, except from the possible reluctance of Congress to appropriate the needed funds.

What American Airmen Are Doing for France

(Editorial in New York *American*)

GENERAL PETAIN, Commander-in-Chief of the French forces, has commended the Lafayette squadron, composed of American airmen, for its courage, spirit and sacrifice. In the general orders of Friday, he said:

"The squadrilla, composed of American volunteers who have come to fight for France in the pure spirit of sacrifice, has fought incessantly under the command of Captain Georges Thenault, who formed it for an ardent fight against our enemies. In very severe combats it has paid the price of serious losses, which, far from weakening, have increased its morale.

"The squadrilla has brought down twenty-eight enemy aeroplanes. It has aroused the profound admiration of commanders who have had it under their orders, and also of French squadrillas which are fighting beside it and have desired to rival it in valor."

It will be gratifying to Americans that their fellow countrymen, fighting for France, have done such excellent service for the country that is America's ally in this war, and to which America has owed a debt of gratitude since the revolution.

And it will be particularly gratifying because these are the soldiers of the air. It is upon airmen and aeroplanes that America bases her greatest hope of victory in the war.

The American spirit of courage and daring is especially valuable in this service. We believe that the American fliers who go over with our own armies will prove the greatest air fighters that the war has produced. Give them the aeroplanes they need, thousands of them, of the best and latest types, and they can be depended upon to perform prodigies of valor.

America originated the aeroplane. Lately, because other nations have had more pressing need for war planes, we have fallen behind them in the development of our own invention. This is now to be atoned for.

Congress has provided for enough machines to make an excellent beginning, and will doubtless provide for more in the future.

The American believes that the war will be won in the air, and that men of the type of those now fighting in the Lafayette escadrille will win it.

Aviation Plans

(Editorial in New York *Times*)

IT is good news from Washington that tests of the first standardized United States aeroplane motors, designed and constructed under the direction of the Aircraft Production Board, have been highly satisfactory. It is doubly good news because, apparently, the motors have been built outside the regular aeroplane factories, and the promise of Chairman Howard E. Coffin of the Aircraft Production Board that he would provide for a large production of motors by utilizing the facilities of the country's automobile plants therefore seems in a fair way to be fulfilled.

Aeroplane makers scoffed at first at the notion that any but they could turn out satisfactory planes or motors, and scientists and students of aerodynamics frankly doubted that Mr. Coffin could put his proposal into practice. The news from Washington indicates that he has done so, and a long step has been taken toward making possible the realization of this country's plans for aviation. Long ago it was clear that the air program called for efforts in excess of any the present aviation industry could put forth, but, with the assurance of capacity orders for themselves, airplane makers should welcome the notable progress made by Mr. Coffin in the utilization of allied fields of industry.

Details of design and performance of the new motors are wisely withheld, but the understanding has been permitted to go forth that they were not designed primarily for speed as much as for durability and high power in proportion to their weight. It is intimated that American military men and engineers are not satisfied to accept the British and French verdict that battleplanes must be exceedingly light, exceedingly fast, and susceptible of the most delicate handling. It is an American notion that perhaps a superdreadnought of the air, heavily equipped with men and armament, may displace the avion de chasse from its grip on air supremacy. In this, American theory has the support of Italian experience. Caproni triplanes have been built in Italy with three motors of 200 and even of 600 horse power each, and one is under construction that will have 3,600 horse power. These craft have proved capable of carrying tremendous loads of men and ammunition, and they have been the vehicles of some of the most successful air raids yet made by the Allies.

Whatever may be the type, however, of the new United States motor, it is encouraging news that the motor has been built, that it has proved satisfactory, and that, by the employment of the first machine as a model, tools, jigs, and dies have been created so that many factories may be equipped to turn out the new motor with speed and precision. It is one of the tasks of the United States to produce aeroplanes. Our Allies are awaiting them, and the success of the war may possibly depend upon, or certainly be hastened by, them. How they are produced, or by whom, is no longer of consequence, but they must be produced quickly and in large numbers.

Build Aeroplanes, Not Discuss Them

(Editorial in N. Y. *Sun.*)

GERMANY has turned the dismantled Zeppelin works at Friedrichshafen into an aeroplane factory. The great ships of the air are being abandoned like the great ships of the sea. The wasps of the air and the vipers of the sea, the swift, savage airplane and the stealthy, silent submarine, are in war's spotlight today.

It is reported that a new type of aeroplane being made at Friedrichshafen is equipped to emit great clouds of smoke, forming a screen to shield it from the assaults of an enemy. This is the latest novelty in the aircraft line to be announced though it has been apparent for some weeks that every country was building new types. As a rule the development has been in the direction of bigger machines carrying heavier or more guns and with an extended cruising radius. This is a radical reversal of the line of development which in the first two years of the war seemed to be the fixed tendency. Then the whole effort seemed to be away from the heavy triplane and bombing machines toward the light, easily manœuvered fighting and scouting machines—the Fokkers, Bieriots, Vickers, Nieuports.

The sudden reversal of plan is to some degree due to the failure of the allied armies and navies to get at the heart of German defence. The world waxed very weary of witnessing all the suffering entailed by war falling upon the peoples of the Entente. But to carry the war back of the German lines, into the German territory, no pathway offered except the air. To attack Kiel or Williamshaven by sea the British naval authorities declared madness. To break through the German lines, even at the points where they are closest to the boundary, and to carry the war into the Fatherland has been proved to be impossible. Only the air offers a way. To meet this situation, to grasp the aerial opening, to seize the mastery of the air, all the German belligerents are building aircraft—beyond doubt the Germans most feverishly of all. In this struggle the United States ought to be the dominant, the determining factor. Since our appropriation of $640,000,000 for aircraft there has been silence concerning the methods of its expenditure, the types of craft we are to build, the rate of progress in their construction. The *Sun* mentions this silence to applaud it warmly.

Silence and swift work are what is wanted from those entrusted with the construction of the American air fleet. The country will bear with the one—eager as it is for intelligence —if it can be assured of the other.

America's Magnificent Opportunity in the Air.

STEADILY the opinion is deepening into the fixed conviction all over the world that this titanic war is to be won in the air. As long as there is still war, we must be ready to do our part in it effectively.

Those long lines of fortified and embattled trenches stretching across France and Belgium to the sea on the west, where the English under Haig face the Germans under Hindenburg, and those other long lines of fortified trenches stretching through the Champagne regions, where the French face the German Crown Prince, seem to make for either side an impregnable barrier to a decisive advance.

The surface of the sea is England's and the dominion under the sea is clearly Germany's.

But the air is the great untaken battlefield, which awaits the conqueror who comes with the mightiest aeroplanes and with the heaviest guns of aerial warfare.

"Providence," said Napoleon in his day, "is on the side of the heaviest artillery!" AND VICTORY IN OUR DAY IS WITH THE MIGHTIEST AEROPLANES.

The Hearst newspapers have preached this doctrine unceasingly from the beginning, and these newspapers now are more than ever convinced that the genius and the common sense of the American war policy is to seize and hold this vast and untaken element of the air in order to decide the war.

The foremost strategists of Europe and America are now united in the opinion that this is the only war policy that promises victory.

The Emperor Constantine, fighting, saw in the heavens above him the sign—In Hoc Signo Vinces—"IN THIS SIGN YOU SHALL CONQUER."

And so to-day the Great Republic, holding the balance of power in the world's vast conflict, and with its eyes turned upward, reads in the aerial lines above us this inspiring legend of prophesy—IN THIS SIGN WE SHALL CONQUER.

And with this conviction fixed in the universal mind America has the power to play the deciding card, and to win the great game of the century.

America has money, America has resources, America has energy, America has the inventive genius, and with our own sacred soil as yet untouched by blood or battles, we have the opportunity to fill the air with the grand conquering army that shall establish peace with freedom and democracy.

PUT OUT THE EYES OF THE ENEMY! Darken the skies above him with the shadow of 100,000 aeroplanes. Prevent his scouts and spies from getting the location and the range of the allied artillery, or from seeing or forecasting the movements of the armies of the allies.

Blind the enemy to the numbers, the movements and strategies of the allied camps.

Then with our outnumbering and over-mastering fleet of aeroplanes, to drive the enemy's air fleet by sheer force of numbers out of the skies, and to take possession of this newest and unlimited battlefield of the air—IS THE CLEAR-CUT, DEFINITE AND DECISIVE WORK WHICH AMERICA HAS TO DO.

Zeebrugge, the great U-boat base from which the German submarines issue forth upon their mission of destruction, seems unreachable by our armies on land or sea. But Zeebrugge is open to destruction from the wide expanse of blue above it, and Zeebrugge through the aeroplanes may be bombarded until the work of the submarine is done.

The Kiel Canal has so far been invulnerable to reach, but with the weight of overwhelming numbers and the hurrying wings of our monsters of the air, the Kiel Canal may be battled out of offensive or defensive menace.

The Krupp Works, at Essen, are the base of Germany's great plant of guns and munitions. The Krupp Works are reachable and destructible as soon as our aeroplanes monopolize the German air and Germany's offensive and defensive can be destroyed.

Already the power of the aeroplane, even in its present status of achievement, has been demonstrated to be ample for its warlike work. Tremendous distances are being compassed in wonderfully short spaces of time through these destructive engines.

Ruth Law, an American girl, on November 19, 1916, flew from Chicago to Hornell, 590 miles, in four hours and seventeen minutes.

Victor Carlstrom, two weeks earlier, had flown from Chicago to Erie, 452 miles.

Alec. Seguin, an adventurous Frenchman, two years earlier, had made a duration flight of 646 miles, in France.

And Lieutenant Marchal, of the French army, on June 20, 1916, actually flew from Nancy over Berlin to Chelm in distant Russia, A DISTANCE OF 807 MILES.

So that there is no limit to the possibilities of the aeroplane in war.

The Hearst newspapers have repeatedly insisted that it is the one great element in which America has the opportunity to reach and maintain a world supremacy in war and peace.

Just as England has been mistress of the seas and as Germany seems to be invincible upon the land, so America, favored by opportunity and resources, should seize this crisis to capture the supremacy of the air with the greatest army of aeroplanes, and to hold it as her proud and untakable place both in war and in commerce for the future.

Alan R. Hawley, the president of the Aero Club of America, before the House Sub-committee of Congress, agreed with the New York American that 25,000 aeroplanes were not enough for America's contribution to the war, and that if necessary our magnificent appropriation of $640,000,000 should be doubled and trebled, that we might build and maintain an aerial army of 75,000 or 100,000 planes.

IT IS WORTH IT—WORTH EVERY DOLLAR OF IT. NOT AN INVESTMENT THAT AMERICA HAS MADE IN THE WAR IS MORE ALTOGETHER WELL WORTH WHILE THAN THIS MULTIPLYING AND MAGNIFYING OF OUR COUNTRY'S PERMANENT CONTRIBUTION TO THE DOMINATION OF THE AIR.

Therefore, gentlemen of the Sixty-fifth Congress, speed the aeroplanes. Multiply the aero plants. Grudge no money that is necessary to their perfection. Press all speed and high tension of energy upon the work.

Let America go at once to the head of this vast new army in this vast new element, to take her place as the decisive factor in this universal war, and to dominate for all time the air currents of the world.

THE NEWS OF THE WEEK

Aero Club Work Stirs War Spirit of Minneapolis

Minneapolis.—The Committee of the Aero Club of America, consisting of Alan R. Hawley, president of the club; Representative Murray A. Hulbert, of New York, and Henry Woodhouse, which came to Minneapolis at the invitation of the State and city authorities, has received hearty receptions from the Minneapolis Club, the Athletic Club, the Rotary Club, the Aero Club of Minneapolis and other leading organizations.

The members of the committee asked the many audiences, which were composed of leading men of Minnesota, to stand behind President Wilson and work for large appropriations to train and equip ten thousand naval aviators needed to conduct major aerial operations against the German fleet and U-boat bases. Victory on the Western front will be only half of the fight and the only way to lessen the U-boat menace is eo destroy the U-boats in their bases, it was declared.

On every occasion the audiences cheered heartily the advice to stand behind President Wilson and to work to get the Navy Department to train and equip the aviators. The committee made every effort to offset the effect of the anti-draft workers and has succeeded.

Representative Hulbert was loudly applauded when he stated that President Wilson is bearing a greater load than any one man has borne since the resurrection.

The newly organized Aero Club of Minneapolis, which includes in its membership leading men of the city, will continue the work started by the Aero Club of America Committee. Ten thousand dollars was pledged to-day toward organization of the Dunwoody Aerial Coast Patrol unit.

Glenn Martin to Organize New Company

Cleveland—Glenn Martin, of the Wright-Martin Aircraft Corp., is in this city conferring with local capitalists on aeroplane manufacture and it is reported that a $2,500,000 concern will be formed, although this amount is not yet definitely determined. All plans are in a tentative condition. Mr. Martin has not yet severed connections with the Wright-Martin Aircraft Corp. Borton & Borton, the Cleveland investment house, is handling the matter with Mr. Martin and according to reports, Charles E. Thompson, president of the Steel Products Co., and Samuel Mather, director of the United States Steel Corp., are reported as connected with the project.

Representative La Guardia a Lieutenant in Aviation Section

Representative F. H. La Guardia of the Fourteenth New York District has been commissioned a First Lieutenant in the Aviation Corps, and he is dropping his Congress career to enter a training camp today.

The Fourteenth District is proud of the fact that he has answered the call of his country for fighting men. He is the first Representative from this State and the third in the country to enter the military service. Representative Augustus P. Gardner of Massachusetts resigned to become a Major in the Quartermaster Corps and Representative Victor Heintz of Ohio went into the National Guard. All three of these men are Republicans.

Mr. La Guardia, who was born in New York City, will be fighting old acquaintances if he gets to the other side. From 1901 to 1904 he was in the consular service at Budapest and at Trieste and for the next two years was American Consular Agent at Fiume. He is not quite thirty-five years old and is the first Republican ever elected to Congress from the Fourteenth District. He lives at No. 39 Charles Street. As an aviator Lieutenant La Guardia will receive $2,000 a year as against his Congress salary of $2,500.

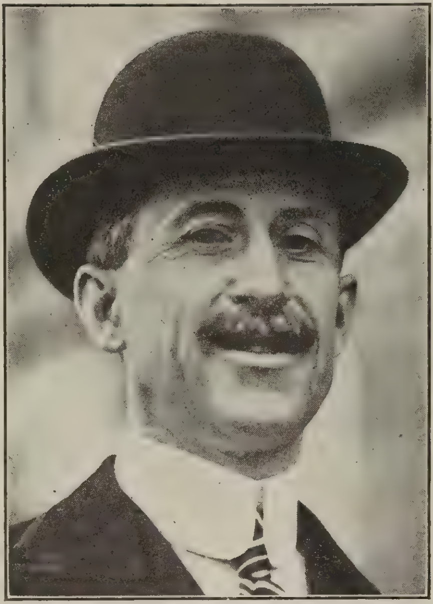
Board Named to Test New Aircraft Gun

Washington, Aug. 17.—The War Department today appointed a board of officers to test the Marlin-Colt aircraft machine gun recently developed by the Marlin Arms Corporation. The test will be made at Springfield, Mass.

The board consists of Major Robert H. Willis, Jr., Captain Herbert O'Leary, Captain Harry J. Malony and L. S. Horner, of Washington.

Hendee Gets Large Order

Hendee Motorcycle Co., Springfield, Mass., has recently received an order for 3500 Indian motorcycles from the Government.



Orville Wright, the pioneer, as he appeared recently at the new U. S. Army Aviation Field at Dayton

Garford Biplane Has Sunbeam Engine

Elyria—The Garford Manufacturing Co. of this city is working on a large tractor biplane, and if the model proves satisfactory to the War Department, may secure an order for this type of machine. The biplane under construction will have a wing spread of 92 ft. and will be equipped with two Sunbeam engines. The engines are already enroute to this city, and a large force of men is at work on the other parts, including the wings, propellers and fuselage.

The new machine is of the battle-plane type and was designed by Captain J. V. Martin. A special transmission is used which permits of driving both propellers from one engine if desired. In addition to the crew of three men, the plane will be able to carry 4,000 lbs. of bombs. It will be equipped with a machine gun mounted directly behind the propellers. The fuselage will be covered with light armor to protect the motor and the crew against bullets from hostile aeroplanes and against shrapnel from anti-aircraft guns. The engines are of 350 hp. each, so that the total horsepower will be 700.

Gen. Squier Visits Chicago

Brigadier General George O. Squier was in Chicago last week to inspect Ashburn Flying Field with a view to reestablishing it as a government training station. General Squier expressed himself as being in favor of retaining the field and suggested that it be made even larger than before. He spent two hours looking over the field. He was accompanied by Major Ira A. Rader, commander of the Chicago division; Major Joseph C. Morrow, in charge of the central division, and the Ashburn Flying Field committee consisting of John H. Lyle, Lawrence Heyworth and Wallace Clark.

Tulane University to Have Aeronautic Course

It is the intention of the authorities of Tulane University of Louisiana to install and maintain a school for technical instruction in aviation under the auspices of the United States Government.

From present indications it is most likely that their hopes will be gratified and plans are already being pushed to place in the hands of the instructors necessary data for teaching the principles and theory of aviation.

Wire Wheel Corporation of America

The Wire Wheel Corporation of America has established a patent department at their general offices in Buffalo, N. Y. Mr. B. M. Kent, of Washington, D. C., has been retained as patent counsel for the company, and will have charge of the work of the department.

Jimmy Ward Joins Aero Corps

"Jimmy" Ward, internationally famous air pilot, has forsaken the professional and exhibition field of aerial endeavor to become an instructor to Uncle Sam's flyer-students. Ward has arrived at the Wilbur Wright aviation field and has been assigned to the civilian instructor corps.

First Flier for United States War Victim.

Baltimore, Aug. 26.—Maryland and the United States have lost their first airman in the fight for democracy.

Flying over the enemy lines in what is thought to have been his first real flight, George Henry Manley, of the six Baltimore boys sent to France in the first American aeronautic detachment, was instantly killed, according to a message from the Navy Department. As far as known, he is the first flier under the United States flag to lose his life in service.

Manley was one of the first to join the Aviation Corps. He was sent to a training station at Pensacola, Fla., remaining there a month when a call was issued for volunteers for immediate service in France. While details are lacking, it is said Manley had just been pronounced efficient. He recently passed his twenty-first birthday, and came here from Maplewood, N. J.

Col. Stewart, of the Canadian Infantry, addressing the aviation students at Bay Shore

Aero Club Organized in Minneapolis

Organization of the Aero Club of Minneapolis, to be affiliated with the Aero Club of America, is announced.

The new entry into Minneapolis life is formed to aid in the general development of aeronautics and to support and assist any local aerial activity, particularly the Dunwoody Aerial Coast Patrol unit and the University of Minnesota school for aviators.

The following committee of fifteen to perfect organization has been appointed:

Fred B. Snyder, William F. Brooks, George K. Belden, Joseph Chapman, A. F. Pillsbury, Sewell Andrews, George F. Mowry, C. W. Gardner, W. W. Eastman, Harvey E. Mack, Fred H. Carpenter, Charles S. Pillsbury, E. J. Couper, A. M. Sheldon, Lieutenant Colby Dodge.

The first activity of the Aero Club of Minneapolis, according to its members, will be the completion of organization. By-laws will be adopted, officers selected, committees named and a charter obtained within the week, it is expected.

A tentative program for the club's activity has been made. Committees to direct the various activities of the club will be named as soon as possible. It is planned to have a committee on coast patrol which will cooperate with the Dunwoody Aerial Coast Patrol unit, now being organized; a committee on aeronautical map making and landing places, which will superintend the making of aeronautical maps of Minnesota in co-operation with Rear Admiral Robert E. Peary, chairman of a similar committee in the Aero Club of America; a committee on enlistments, which will aid all government recruiting officers, and committees to handle any particular phase of aeronautics that becomes active in Minneapolis.

"The belief of the men who thought it expedient to organize the Aero Club of Minneapolis is that aviation is the most important feature of our military and naval activity," said a member of the organization committee. "We base our belief on the teachings of Rear Admiral Bradley A. Fiske, Alan R. Hawley, Henry Woodhouse, General Squier, and other leaders in aeronautical matters.

"We see among other things immediate necessity for arousing America to a realization of the importance of increasing our aerial forces.

"The Aero Club of Minneapolis will be one of a chain of such clubs over the entire nation. There now are twenty-seven such organizations affiliated with the Aero Club of America, national body, and in turn affiliated with an international organization for the improvement of aviation.

"We hope, for one thing, to get the people of Minneapolis and Minnesota to thinking about aviation. We want to spread broadcast the facts of aviation. We want to do our share in impressing on our legislators the importance of our air forces."

Membership in the Aero Club of Minneapolis will be open to any citizen, it was announced. It is hoped 1,000 or more persons will join within the next few weeks.

The club will be addressed next week by Rear Admiral Fiske, Mr. Hawley and Mr. Woodhouse, when those men are in Minneapolis to witness the tests of the Fiske torpedo by Floyd Smith in a Wright-Martin seaplane during the regatta on the Mississippi River.

A. P. Bourquardez, Vice-President and Sales Manager of the General Vehicle Company

New England News

The Aeronautical Department announces that all Massachusetts men will be paid $10 per month by the State during their period of training as aviators and observation balloon pilots in addition to the $100 per month and rations and sleeping accommodations allowed by the Government. The period of training is about six months, after which if they graduate they will receive the first lieutenants' commission, under which a base salary of $2,000 annually is paid. Applications must be made before men are posted under the draft.

The total number of applications to date is 1,400, or only 200 short of New England's quota to the 25,000 but New England will not stop here, but continue until 5,000 applications are secured, as there is no reason why New England should not furnish one-fifth of the Aviation Army.

About ten percent are being rejected on account of vision, which is the principal cause for the non-acceptance of applicants, rejections for other causes being less than two percent. The vision required with glasses removed is known as the 20-20 test.

Among the applicants for the position of observation balloon pilots are telegraphers, bank clerks and clerks in department stores, who receive $100 per month while learning, and a lieutenant's commission when they graduate. Salary $2,000 per annum.

The newly erected motor testing equipment of the Thomas-Morse Aircraft Corporation

Wilfred A. Ouimet, brother of the celebrated golf player, has applied for first lieutenant's position as an aviator.

Two American Airmen Die Fighting at Front

Chadwick, of Lowell, and Biddle, of Philadelphia, Victims—One Captured.

Paris, Aug. 22.—Death of O. H. Chadwick of Lowell, Mass., and Aviator Biddle, also an American, in recent fighting on the west front, was confirmed in dispatches to-day. Corporal Harold Willis, of Boston, a member of the Lafeyette escadrille, was announced as a prisoner of war of the Germans.

From an official front source it was learned that Chadwick was shot down from a considerable height. A French observation balloon saw the wreckage of his plane plunge to the earth.

Biddle was killed August 18. Details were lacking.

Willis was forced, presumably by disablement of his plane, to descend within the German lines and was seized as a prisoner.

S K F Unbeatable

The S K F Baseball team, representing the S K F Ball Bearing Company in the Hartford Industrial League, has come thru the league season with a perfect record. Against such teams as Colt's Patent Fire Arms, New Departure Mfg. Co., Pratt & Whitney, Arrow Electric and Hartford Rubber Works the S K F boys have compiled a string of thirteen victories and no defeats.

This gives them a perfect percentage for the season and with it goes the league penant. The S K F team is to meet the Singer Sewing Machine team of Bridgeport for the industrial championship of Connecticut and there has also been some talk of a series with the Hess-Brights of Philadelphia.

Smoke Bomb Explosion Kills Airmen

Buffalo—Premature explosion of a smoke bomb being tried out for Government use caused the death on August 23 of R. H. Mead, Curtiss Aeroplane Company instructor, 27 years old, of Boston, and Charles Wall, 32 years old, son of a Buffalo physician.

The men had gone up to demonstrate a smoke bomb which the inventor, who witnessed the accident, is trying to sell to the Government. They had risen 700 feet when they exploded safely the first bomb. Wall was leaning over to explode the second when it went off in his hand. Instantly the planes were in flames and the machine dived downward.

Wright-Martin Plan No New Financing

A report in the Wall Street Journal reads as follows:

"Wright-Martin Aircraft Corporation is contemplating no new financing at this time in spite of the persistent stories by bears on the stock that new financing is imminent.

"The sale of more than 500,000 shares of new common stock at $5 a share, a short time ago, put approximately $2,700,000 in the corporation's treasury, of which about $2,500,000 remains after paying pressing bills. The company therefore is amply supplied with working capital for ordinary business, has no floating debt and likewise no bonded debt, the stock representing the only capital obligations.

"If the needs of the Government force the company to production that will exceed present facilities and require extensions, the Government, it is said, stands ready to finance the increased output. The company will therefore not be compelled to do any further financing, but if the order for 5,000 Hispano-Suiza motors, for which the Government is now negotiating, is closed the latter will advance the funds required to provide for this increased output.

"Wright-Martin is now said to be producing and shipping five Hispano-Suiza motors a day, and it is also said that the French Government with whom the original contract was made, has notified our Government (not the corporation) that the parts of the American-made motor are interchangeable with the French-made motor and that the American make is superior to the motors made in France. Our own Government wants Wright-Martin to produce as many of these motors as it can, and undoubtedly the order for 5,000 and assurances of Government financial aid will be secured.

"Reports that Orville Wright and Glenn L. Martin are organizing independent aeroplane companies and have severed their connection with the Wright Corporation are only partly true. Both are organizing independent companies but it is done to stimulate construction of planes and widen the market for Hispano-Suiza motors produced exclusively under patent license from the French Government by the Wright-Martin Corporation. The latter is bending every effort to, and specializing in, the production of Hispano-Suiza motors. The more plane factories there are the bigger the market for the Hispano motor and the earlier will the Government's aeroplane requirements be filled."

The Curtiss Triplane Scout

The Curtiss Triplane Speed Scout is essentially a one-man machine designed for speed and great climbing ability. Inasmuch as its safety in war, like that of the Torpedo Boat Destroyer in the Navy, depends upon its ability to dart here and there, with a swiftness that precludes successful pursuit, this little craft is so compacted in size and so intensely powered as to be able to make the maximum speed of 115 miles per hour; yet will fly at the slow speed of 55 miles per hour.

Under normal conditions, it is able to leave the ground in less than 300 feet and it has frequently, in tests, been made to climb 9,000 feet in 10 minutes.

Due to its small size it rapidly becomes imperceptible to the eye after it has been in the air a few minutes. At 5,000 feet it is barely a dot; at 1,000 feet it is out of sight to the average human eye.

It has a total wing spread of 25 feet and an overall length of 19.5 feet and stands less than 9 feet high. It differs quite materially, in general construction, from any of the other Curtiss models, not only in its triplane wing design but in the style of struts, bracing and general assembly. The entire fuselage is covered and even the propeller hub is fitted with a truncated, streamline hood, which assists in cutting down the wind head-resistances.

Equipped with wireless it can be made a wonderful aerial observation point as well as for military reconnaissance and fast scouting work.

An altitude of 16,500 feet was attained with it on its second trial flight.

Imperial Japanese Mission Arrives in America

Washington.—The Imperial Japanese mission arrived in Washington, August 20. The mission consists of the following:

Viscount Ishii, ambassador extraordinary and plenipotentiary.

Vice Admiral Takeshita, Imperial Japanese Navy.

Maj. Gen. Sugano, Imperial Japanese Army.

Mr. Masanao Hanihara, consul general at San Francisco.

Mr. Matsuzo Nagai, secretary of the foreign office.

Commander Ando, Imperial Japanese Navy.

Maj. Tanikawa, Imperial Japanese Army.

Mr. Tadenao Imai, vice consul.

Mr. Tashiro Owaku, secretary.

Mr. Douglas L. Dunbar, American secretary to the mission.

The mission came to Washington on a special train from San Francisco, which was their port of arrival. They were met at San Francisco and were accompanied here by the following representatives of the American Government:

Breckenridge Long, Third Assistant Secretary of State.

Ransford S. Miller, consul general at Seoul, Korea, formerly chief of the Division of Far Eastern Affairs of the Department of State, aid to Viscount Ishii.

Brig. Gen. James A. Irons, United States Army, formerly military attache of the American embassy, Tokyo, aid to Gen. Sugano.

Capt. C. C. Marsh, United States Navy, aid to Vice Admiral Takeshita.

At the Union Station the mission was greeted by the Secretary of State, Assistant Secretary of State Phillips, Mr. A. B. Ruddock, secretary of embassy, attached to the Department of State.

There were also at the Union Station two troops of Second United States Cavalry, which acted as an escort from the station to the home of Mr. Perry Belmont, 1618 New Hampshire Avenue, which has been loaned by Mr. Belmont for occupancy by the mission.

Activities of Various Stations of Signal Corps

The Chief Signal Officer authorizes the following:

Temporary Signal Corps Aviation Station, Essington, Pa., Aug. 11.—During the week 163 flights were made with a total duration of 66½ hours. The examining board at this station continued to examine applicants in the aviation section, S. O. R. C., and a number of enlistments were accepted.

Ancon, Canal Zone, Aug. 2.—A temporary flying field has been established at a point in the Canal Zone, where hangars and storehouses have been erected. The Canal Zone is not suitable to the operation of land machines and it is almost impossible to find suitable landing fields. Capt. Tussell is the acting department aeronautical officer, Canal Zone.

Fort Mills, Philipine Islands, July 7.—Maj. W. Lay Patterson, in his reports covering the previous two weeks, mentions but one short flight. Prior to July 5 there was a long period of almost absolute calm air, which made it impossible to get off the water in one of the seaplanes even with the pilot alone.

Minneapolis Will Have Aerial Patrol

Chicago, Ill.,—Representative Murray Hurlbert, of New York, one of the Aerial Coast Patrol Commissioners, accompanied by Alan R. Hawley, president of the Aero Club af America, and Henry Woodhouse, one of the Board of Governors of the club, arrived here en route to Minneapolis, where they will institute Aerial Coast Patrol Unit No. 4.

Mr. Hawley said the party would visit several Western cities for the purpose of arousing popular enthusiasm on the subject of naval aeronautics, so as to insure an appropriation by Congress at an early date sufficient to carry out a programme of naval aeronautics on a plane with that provided for the army by the recent appropriation of $640,000,000.

Lieut. Layton Takes Charge of British Station Here

Lieutenant Layton, of the Royal Flying Corps of England, took command recently of the Royal Flying Corps recruiting station of the British army, at 453 Fifth Avenue. He relieves Captain Denton, who has been transferred to American aviation work.

Lieutenant Layton entered the war at its start as chauffeur for General Sir William R. Robertson. Later he went into the trenches, and received his commission on the battlefield for gallantry. He was an observer for several months at Loos, and was finally invalided home. He spent three months in a Canadian hospital and then joined the Royal Flying Corps.

To England he was sent as an instructor, but later returned to Canada, still an instructor. From Canada he was ordered to this city.

Standard Aero Corporation Has New Plant

The Standard Aero Corporation announces that it has bought the John Stephenson plant at Elizabeth, N. J., and shortly will be able to turn out sixty aeroplanes a week. The price paid was $750,000. The new works will employ 6,000 persons, of whom 1,200 will be women.

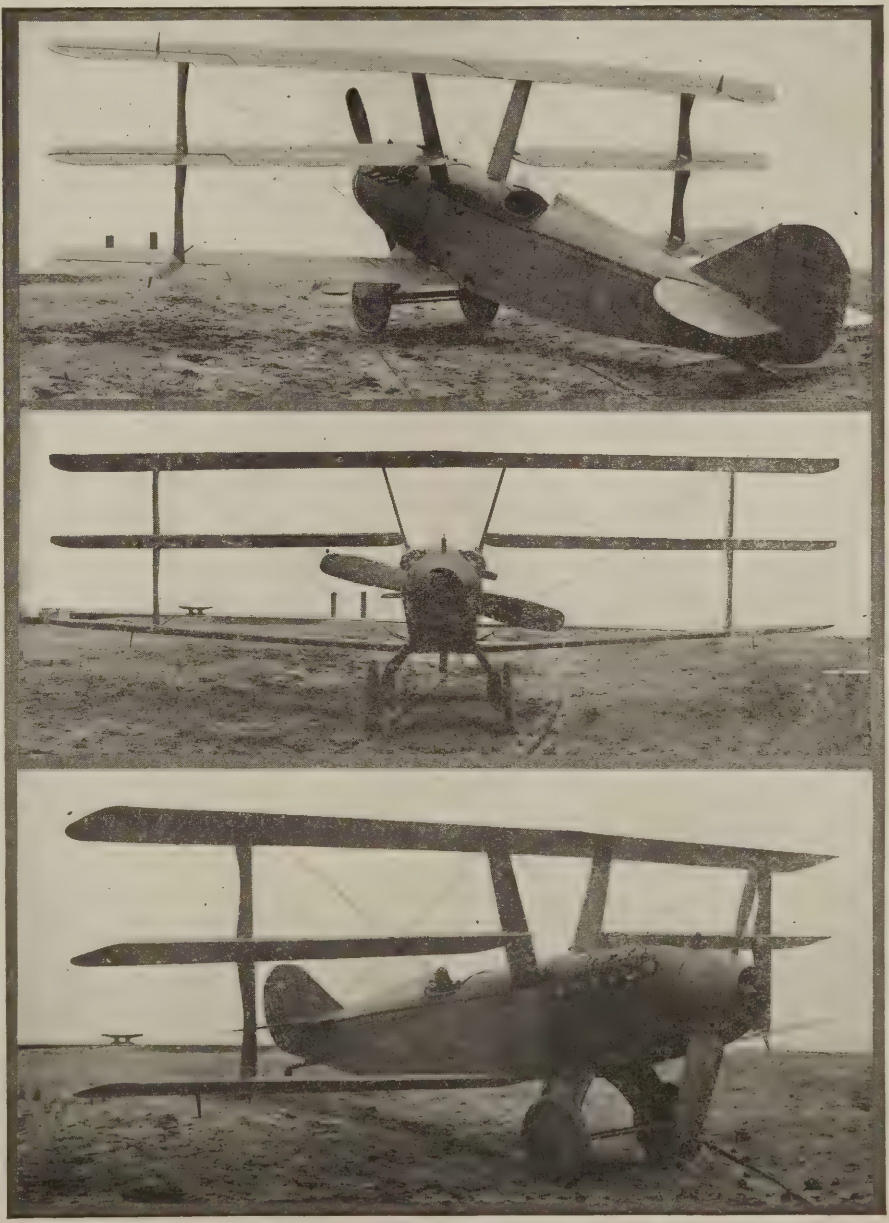
Call for Aero Volunteers

Washington, Aug. 24.—The War Department has issued a call for thousands of young men to volunteer for the Aviation Corps. The bureau's action means that Brig. Gen. Squier, Chief of the Signal Corps, and the Air Production Board have completed plans for the construction of the great fleet of machines which the United States will turn out within a year.

Arrangements have meen made to teach and train the new army of air men. Everything is ready. All now required is men who have the proper qualifications.

Here is the text of the call issued by General Squier:

"It is desired to obtain applications from all Reserve Corps officers who have finished the special course of instruction at Fort Monroe, Va., or at Fort Sill, Okla., and from enlisted men or civilians who are expert photographers, radio operators or machine gun operators for service in the aviation section. Signal Officers' Reserve Corps, as candidates for commissions as observers from aeroplanes. The preferable age for all applicants is from twenty-five to thirty-five. A good education, fine physical condition, keen eyesight and ability to judge distances accurately are essential. Previous military experience is very desirable.



Three views of the Curtiss baby triplane which is briefly described on this page

"It is the intention to assign successful candidates to a school for a period of instruction of two months. This course will cover study of fire from aeroplanes, reconnaissance, photography, radio and bomb dropping.

"Candidates who desire to make application for this position should write to the Aero Personnel Division, Chief Signal Officer of the Army, War Department, Washington, who will furnish them the necessary information and blanks for making application to take examination.

"Candidates who complete the course successfully will be commissioned in the Signal Corps and will be eligible to promotion. Twenty-five per cent. additional pay is authorized for all officers who are on duty requiring frequent and regular aerial flights."

Aviation "Ground School" Class Graduating August 18

List of graduates, August 18, from schools of military aeronautics:

Ohio University.—Donald C. Malcolm, Howard W. Nestor, Harold F. Hoitz, Lew W. Springer, Charles B. Baldwin, Gordan L. Harwell, Sidney Isaacs, C. L. Jones, Temple N. Joyce, Wilbur D. Kennedy, Harold A. Lorick, Mason L. Merrill, R. K. Morris, John P. Pepper, Clifford G. Sample, Leo J. Stevens, Jacques M. Swaab, Henry R. Swartzell, Wallace H. Carpenter, and Mark R. Woodward.

University of Texas.—Winthrop N. Kellogg, Oble H. Mitchell, Donald Smith, Richard Wagoner, James B. Baily, T. Leonard Bradford, Jr., Samuel A. Buckmaster, F. M. Daugherty, Arthur R. Epperson, Frank S. Estill, Waldemar H. Fries, Russel F. Hall, Andrew W. Johnson, Wallace H. Rowell, Thomas L. Rouse, Paul A. Smith, Reginold Whitney and Alex. F. Hill.

University of Illinois.—Merrill Blanchard, R. F. Linkenhoker, James H. Vidal, Clarence M. Young, Frank S. Latham, Jr., Frank Banks, Charles E. Bradley, William N. Bratton (to be sent to Mineola), Alfred C. Carrier, Russel T. Cowgill, Walter C. Davis, Louis Feldman, Jr., Albert C. Foulk, Roswel H. Fuller, Harold DeF. Gale, Donald W. Gleason, Harold M. Graham, Alfred D. Hawley, Ralph J. Johnson, Martin B. Kugler, William R. Kuhn, Alfred J. Lyon, W. S. McDuffee, George A. Miller, Clifford C. Nutt, W. L. Purcell, Hugh M. Rice, Glen C. Salisbury, Hudson R. Searing, Harry A. Smith, Gordan Statham, Charles L. Thomas and James E. Roth.

Massachusetts School of Technology.—Robert H. Austin, Walter L. Avery, Willis S. Fitch, Norman Hunt, Gilbert Jerome, F. E. Alexander, Brooks G. Bird, Charles T. Buckly, Leland V. Clark, Charles J. Clearly, Harold Cohen, Robert E. Ellis, Maurice Friedman, William D. Grant, Granville L. Hancock, Walter L. Johnson, Amos M. Kidder, Herbert H. McVey, Ralph M. Phelps, Norris E. Pierson, Frederick C. Rockstroh, Perley M. Stoughton, Stephen T. Webster, Merritt O. White, Le Roy Woodward, Andrew J. Shannon and Francis M. Fonseca.

University of California.—Harold B. Laidlaw, Mowatt M. Mitchell, James A. McBrode, Joseph Waddell, Henry G. Andrews, Alfred B. Bigelow, St. John L. Eaton, James A. Eldridge, Ira F. Fuller, Harold F. Hanes, Mark Herron, Raymond W. Kearney, Egbert J. McKean, Geoffrey Montgomery, Louis J. Murphy, Samuel J. Mustain, Maurice C. Myers, August G. Rehlmeyer, Albert G. Simpson, Eldridge T. Spencer, Roy W. Vollman, Thomas A. Wooten and Emory E. Watchorn.

Cornell University.—Ulysses C. Jones, Robert P. Cross, John Michener, Everett F. Howarth, Emerson Plank, John G. Agar, Homer B. Albro, Ogden D. Blackman, Jr., William A. Calkins, Robert Carrigan, Charles L. Clark, Maurice W. Crook, Herbert F. Duggan, Harvey F. Houck, Theodore H. Hubbard, Otis A. Kinney, Minor C. Markham, John B. McCue, Irving S. Merange, Louis E. Neidhart, Earl A. Neubig, Henry H. Nutt, Raymond A. Watkins and Ogden J. Budd.

Georgia University.—John W. Aiken, Billy G. Rushing, Howard C. Snyder, Hugh A. Bivins, Charles G. Blackard, Robert M. Caldwell, Samuel M. Connell, D. R. Cope, Edmund P. Gaines, Robert C. Harrington, Rutledge M. Lawson, O. T. Ridley, P. O. Roberts, Kinsey L. Stewart, James H. Turner, John W. Vanheuvel and Harry L. Wingate.

Orders of July 31, relating to Capt. T. G. Gallagher, Av. Sec., revoked.

1st Lieut. E. A. Coleman, Av. Sec., will report to Chief Sig. Officer for duty.

Capt. J. B. McCalley, Av. Sec., to participate in aerial flights.

Army and Navy News

Signal Officers' Reserve Corps, Aviation Section.

Stevens, George, Capt., 7-10-17, New York City.
McConnell, Thomas H., Capt., 7-10-17, Washington D. C.
Mills, Ogden L., Capt., 7-16-17, New York City.
Knight, Theodore C., 1st Lieut., 7-5-17, Buffalo, N. Y.
O'Rourke, John J., 1st Lieut., 7-10-17, Brooklyn, N. Y.
Hagerty, Edwin B., 1st Lieut., 7-10-17, New York City.
Molton, Joseph G. B., 1st Lieut, 7-10-17, Philadelphia, Pa.
Norton, Dudley S. 1st Lieut., 7-10-17, Nerion Station, Pa.
Ordway, Lucius P., Jr., 1st Lieut., 7-10-17, Washington, D. C.
Gaines, Albert B., Jr., 1st Lieut., 7-10-17, Englewood, N. J.

Capt. John W. Butts, Jr. Mil. Ava., S. C., to Mineola, N. Y., for duty. (Aug 13, War D.)

Aviation Officers

Capt. Herbert S. Brown, Av. Sec., S.O.R.C., to Langley Field, Hampton, Va. (Aug. 16, War D.)

First Lieut. Fiorello H. LaGuardia, Av. Sec., S.O.R.C., to report to C.S.O. of Army for assignment to duty. (Aug. 16, War D.)

Major Robert A. Milliken, Av. Sec., S.O.R.C., to duty and will report to the chief Signal Officer of the Army for duty. (Aug. 14, War D.)

Major Augustus Trowbridge, Av. Sec., S.O.R.C., to duty at Washington. (Aug. 14, War D.)

Capt. Thomas Hitchcock, Av. Sec., S.O.R.C., to duty at Mineola, N. Y. (Aug. 14, War D.)

Capt. Howard F. Wehrle, Av. Sec., S.O.R.C., to Fort Sam Houston, Texas, for duty. (Aug. 13, War D.)

Capt. Chester H. Teegarden, Av. Sec., S.O.R.C., to duty at Washington. (Aug. 14, War D.)

First Lieut. Harry C. Dayton, Av. Sec., S.O.R.C., to duty at Mount Clemens, Mich. (Aug. 14, War D.)

Capt. Julian C. Smith, Av. Sec., S.O.R.C., to duty Fort Sam Houston. (Aug. 11, War D)

First Lieut. Howard A. Scholle, Av. Sec., S.O.R.C., to duty Fort Omaha, Nebr., Army Balloon School. (Aug. 11, War D.)

First Lieut. Gilliland Stikeleather, Av. Sec., S.O.R.C., to duty Fort Sam Houston. (Aug. 11, War D.)

First Lieut. Harold E. Bardwell, Av. Sec., S.O.R.C., to duty 1st Reserve Aero Sqn., Mineola, N. Y. (Aug. 11, War D.)

Officers of Av. Sec., S.O.R.C., to duty Wilbur Wright Field, Fairfield, Ohio, for duty: First Lieuts. Paul Goldsborough, George F. Hughes, Claude O. Lowe and Charles E. Trowbridge. (Aug. 11, War D.)

1st Lieut. H. H. Salmon, Jr., is relieved as a member of the board appointed in orders of Feb. 19 to meet at Sig. Corps Aviation Station, Mineola, L. I., to examine applicants for appointment in Avia. Sec. of S.O.R.C.

Capt. H. S. Brown, to Langley Field, Hampton, Va, for duty.

Capt. L. B. Lent, from duty at Curtiss Aero Co., Buffalo, N. Y., to Langley Field, Hampton, Va., for duty.

Capt. E. B. Lyon, Junior M. A., is detailed a member of the board appointed to meet at San Diego to examine officers for rating as J. M. A., vice Major G. L. Gearhart, relieved.

1st Lieut. F. H. La Guardia, Av. Sev., Signal Officers' Reserve Corps, will report to Chief Sig. Officer for duty.

Major Herbert Parsons, Av. Sec., S.O.R.C., to duty in office of Chief of Staff, War D. (Aug. 9, War D.)

Capts. Willard Wadsworth and Percy H. Jennings, Av. Sec., S.O.R.C., to report in person to commanding general, Eastern Dept., for assignment to duty. (Aug. 8, War D.)

Capt. Charles C. Jones, Av. Sec., S.O.R.C., to duty at Essington, Pa. (Aug. 6, War D.)

Capts. Robert M. Colt and James A. Northrup, Av. Sec., S.O.R.C., to duty in office of Chief S.O. of Army. (Aug. 8, War D.)

First Lieut. Harold Minott, Av. Sec., S.O.R.C., to report to Chief S.O. of Army for duty. (Aug. 7, War D.)

First Lieut. Lawton V. Smith, Av. Sec., S.O.R.C., to Fort Sam Houston, Texas, for duty. (Aug. 6, War D.)

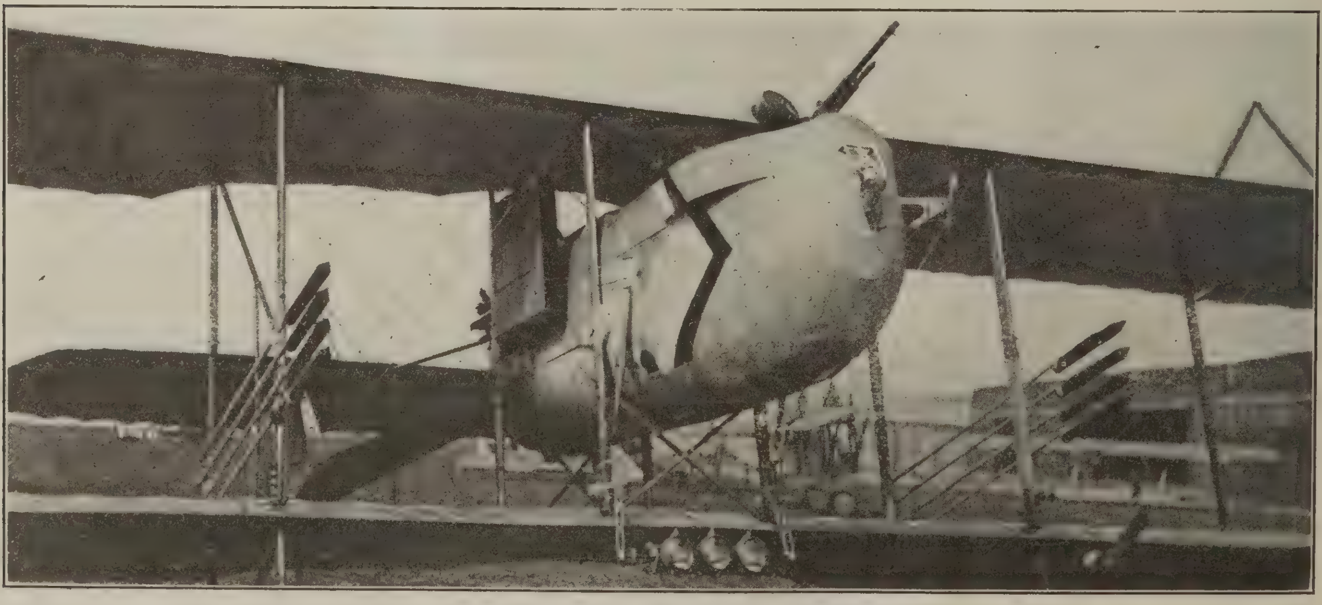
First Lieut. John H. Packard, 3d, Av. Sec., S.O.R.C., to report to Chief S.O. of Army for duty. (Aug. 7, War D.)

First Lieut. Eugene Sibley, Av. Sec., S.O.R.C., to active duty in office of C.S.O. of Army. (Aug. 6, War D.)

First Lieut. Spencer Brainard, Av. Sec., S.O.R.C., to duty at Mineola, N. Y. (Aug. 6, War D.)

First Lieut. Franklin K. Lane, Jr., Av. Sec., S.O.R.C., to Washington for duty. (Aug. 8, War D..)

Major Raymond D. Smith, Av. Sec., S.O.R.C., to report to C.S.O. of Army to duty in his office (Aug. 10, War D.)



The newest Zeppelin chaser—a French machine which carries a machine gun mounted in front of the car, and attached to the frame work are a series of rockets, and below the lower wings a battery of searchlights

Major Harry B. Kirtland, S.O.R.C., is honorably discharged. (Aug. 10,, War D.)

Capt. William K. Evans, Av. Sec., S.O.R.C., to headquarters, Central Dept., duty as assistant to department intelligence officer. (Aug. 9, War Dept.)

Capt. Clarence M. Foss, S.O.R.C., to duty Scott Field, Belleville, Ill., as engineer officer. (Aug. 9, War D.)

Capt. George W. Muller, Av. Sec., S.O.R.C., to Chicago, Ill. (Aug. 9, War D.)

First Lieut. Joseph G. B. Molten, Av. Sec., S.O.R.C., to duty at Fort Scott Field, Belleville, Ill. (Aug. 9, War D.)

First Lieut. William H. Warren, Av. Sec., S.O.R.C., to report in person to C.S.O. for assignment. (Aug. 9, War D.)

First Lieut. Lawrence Schenk, Av. Sec., S.O.R.C., to report in person to commanding general, S.D., for duty. (Aug. 10, War D.)

Officers of Av. Sec., S.O.R.C., to duty at Chanute Field, Rantoul, Ill.: First Lieuts. E. W. Kilgore, W. W. King, W. H. Murphy, J. M. Foote and Percival Dodge. (Aug. 11, War D.)

Officers of Av. Sec., S.O.R.C., to duty at Selfridge Field, Mount Clemens, Mich.: First Lieuts. W. P. Jacob, C. F. Smythe, L. L. Snow, T. E. Tillinghast, H. P. Trainer, T. H. Webb and T. Boland. (Aug. 11, War D.)

Officers of Av. Sec., S.C., to duty as follows: Capt. Albert P. Loening, 1st Lieuts. Quentin Twochtman and Lester Watson to Washington; 1st Lieut. J. H. Hyman to report in person to commanding general, Southern Dept., for duty; 1st Lieuts. Fred Netcher, Harry B. Close and Bolton L. Corson to Fort Sam Houston, Texas, and Capt. Leon B. Lent to Buffalo, N. Y.

Officers of S.O.R.C. to duty as follows: First Lieut. J. C. Tureck to Langley Field, Hampton, Va.; Capts. H. S. Brown and L. B. Lent to Langley Field, Hampton, Va. (Aug. 16, War D.)

Maj. J. C. Morrow will report to Maj. H. H. Arnold, Sig. Corps, President of the board appointed July 19 for examination for rating as military aviator.

The following will report to Com. Officer, Wilbur Wright Field, Fairfield, Ohio, for duty:

FIRST LIEUTENANTS

P. Goldsborough
C. O. Lowe
G. F. Hughes
C. E. Trowbridge

1st Lt. G. Stikeleather to Ft. Sam Houston, for duty in Southern Dept.

1st Lt. H. A. Scholle to Ft. Omaha, Army Balloon School, for duty pertaining to aeronautics.

Capt. A. D. Smith to San Diego, Cal., Aviation School, for duty.

1st Lt. H. W. Tittel will report to Com. Officer, Sig. Corps, Aviation School, Mineola, L. I., N. Y., for duty.

1st Lt. R. G. Page is announced as on duty requiring him to participate regularly and frequently in aerial flights.

Crash in Air Kills Aviator

Toronto.—Stephen H. J. Dorr, of 93 Front Street, New York City, an American cadet, who came from the camp at Fort Meyer, Va., was burned to death August 16, following a collision with an aeroplane driven by Cadet George Squires, also of Virginia. The accident occurred at the aviation camp, Armour Heights, North Toronto. Cadet Dorr is a son of Stephen H. Dorr, of New Jersey.

Squires was able to manage his machine and reached earth safely.

Princeton Fliers Back for Orders

Princeton.—Twenty-six cadets of the Signal Corps, composing the first squadron to be graduated from the government aeronautic school at Princeton, returned here and are awaiting orders for service on Saturday morning. These men received the diplomas for having passed the eight weeks' course in the ground school.

This diploma entitles them to the rank of cadet in the Signal Corps, of which the aviation is still a part. The men after their graduation received a thirty-six-hour leave. The men, whose names follow, are chiefly undergraduates of the university and received the benefit of the original Princeton flying school. Those graduated are: Honor men, W. Morris, S. E. Brewster, L. C. Holden, Jr,; G. A. Vaughn, A Bevin, N. Bevin, B. H. Bostick, H. K. Bulkley, M. H. Pyne, P. R. Pyne, Jr.; H. Raferty and P. B. Nelson. Others who received diplomas are: D. E. Bardwell, C. E. Brown, F. C. Burger, E. Keenan, W. B. Kelly, P. B. King, W. B. Knox, F. Newbury, F. W. Sidler, E. W. Springs, A. R. Taber, W. H. Neely, G. A. Bond and F. Dixon.

Aero Propeller Kills Youth

Dayton.—The first death at the Wilbur Wright aviation school, near this city, is that of a young student aviator, R. L. Hayes, who lost his balance while watching a rapidly revolving propeller on an aeroplane, and toppled over on the propeller.

A group of Army Aviation Students at one of the training fields

Radio School at Harvard

There is at Harvard a new school not connected with the regular course, which has a thousand students preparing for war. It is the United States Naval Radio Training School of Harvard University. President Lowell, as we have heretofore noted, offered the facilities of the college for the purpose when he learned that such a course would be of service to the Navy. The communications division of the Bureau of Navigation was placed in charge and it has established a course of training which fits the students who have enlisted as electricians or as radio men for independent work. It grounds them thoroughly in the principles of the art and makes them ready for radio and electrical duties. It teaches, of course, the Navy methods of operation.

The course includes military training so that when the enlisted man is graduated, he is ready to be sent on shipboard or to a shore station for duty.

A man has to study for a period of from one to six months according to his natural ability, his application and the degree of his preparation.

Memorial Hall, given in honor of Harvard men who gave their lives for the country, has been rededicated to the service of the nation; for its main hall has been set apart for a subsistence room for these enlisted men and the great gymnasium where the crimson athletes have trained for the contests of peace has been converted into a dormitory.

The school will accommodate more than a thousand men, and although that number has entered there are still opportunities; for every day sees some ready to leave the institution for the greater school of the Navy. The communications division has also established a number of schools throughout the country for training men preparatory to their entering the Radio Training School.

Aero Experts See Army Balloons Fly

St. Louis.—A committee of the Aero Club of America, consisting of Representative Murray Hulbert, Alan R. Hawley and Henry Woodhouse, inspected the Missouri balloon school, where army balloon observers are trained. They witnessed the inflation and sending off of two balloons loaded with students, who landed several hundred miles away.

The committee went to the Scott aviation field in the afternoon. Fifteen hundred men are at work finishing the new army field, which is most efficiently laid out. The committee leaves St. Louis for Dayton, where it will visit the army aviation school in operation there.

French Nieuport Scout and French and American Instructor discussing its special features at a U. S. Army field

BURGESS TWIN-MOTORED HYDROAEROPLANE

TRIALS are now under way to list for official purposes the performance results of the twin-motored hydro which has just been completed at the Marblehead factory. The design takes in consideration the advantage of locating a machine-gun operator forward of the planes and propellers. The machine, besides being equipped with the usual complement of instruments, has the Sperry gyroscopic stabilizer and other improved installations.

General Dimensions

Span, upper plane	72′ 0″
Span, lower plane	51′ 9″
Chord, both planes	7′ 7″
Gap between planes	6′ 11″
Length over all	32′ 5″
Height over all	13′ 3″
Gross weight	5,380 lbs.
Motors (2) Sturtevant 5A, each	150 H.P.
Gliding angle	8½ to 1
Climb in 10 minutes	3,500 feet
Speed range, loaded	78-45 m.p.h.

Planes

Upper plane is in 5 sections—the flat center section 12′ 6″ wide; the outer sections each 16′ 8″ wide; and the overhanging sections 11′ 4″ wide. The ends of the ailerons project beyond the wing tips at either side for a distance of 1′ 6″.

Ailerons on the upper plane are 12′ 10″ in length, minimum with 2′ 1″, maximum width 3′ 5″. A small balancing portion beyond the wiring tips extend forward of the rear main wing beam. Control arms are located 7′ 0″ from the inner end of aileron.

With the exception of the center sections, the planes are swept back at an angle of 3 degrees. On the lower plane, this angle corresponds to a distance of 10¾″ that the straight portion of the leading edge recedes from a straight line at right angles to the fuselage center.

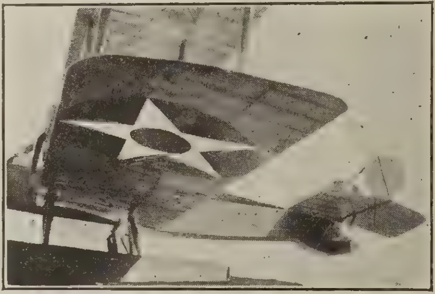
Dihedral angle, center section, upper plane, 180 degrees. Dihedral angle of other wing sections 178 degrees.

Upper and lower planes are set at a 3-degree incidence angle, equal to rise in the leading edges of 4 13/16″. The transverse and lateral center of gravity is located 2′ 11″ from the leading edge, at which point a hoisting eye is located.

Centers of wing beams are located as follows: Front beam 9¼″ from leading edge; beams 4′ 6″ apart; trailing edge 2′ 3⅞″ from center of rear beam. Wing chord, 7′ 7⅜″.

Fuselage

The fuselage is 27′ 6½″ long; maximum width, 2′ 4″. Maximum depth between longerons, 2′ 11″. The nose extends 6′ 11″ forward of the main planes. The observer's cockpit is located at the nose, and the pilot is located immediately below the trailing edge of the upper plane.



Location of vertical fuselage members are indicated by dotted lines on the drawing. The fuselage termination is 18″ high, formed by a strut which carries the central rudder and also supports the tail float.

Tail Group

Horizontal stabilizer, 16′ 0″ across at the trailing edge. Width, 4′ ½″. The leading edge is straight for a distance of 13′ 4″,′ then curved in a 9″ radius to a raked angle. It is non-lifting. Elevators are 16′ 8½″ from tip to tip. Maximum width, 3′ 8″. Control posts located 6′ 0″ apart, one on each flap.

The vertical fin is 3′ 2″ high, and to it the central unbalanced rudder is hinged. The central rudder is 2′ 3″ wide.

In addition to the central rudder, there are a pair of balanced rudders located 6′ 0″ to either side of the fin. These rudders have a maximum height of 3′ 2″ and a width of 2′ 2″.

Floats

Floats are arranged catamaran style, with centers 10′ 0″ apart. Each float 3′ 0″ wide, 19′ 1½″ long and 2′ 0″ in overall depth. A step 3¾″ deep is located 11′ 10½″ from the front end. Struts to the fuselage are located at the following distances from the nose: 4′ 3″; 4′ 9″; 5′ 0″. The dotted and dashed line indicates the water line with the machine fully loaded with a weight of 5,380 lbs.

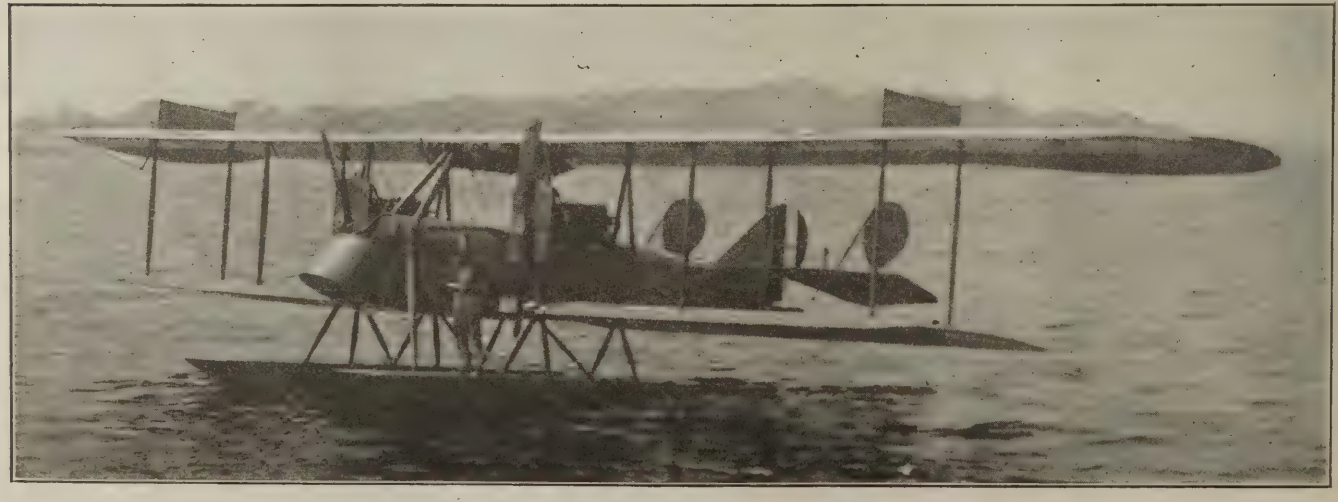
The tail float is 19″ wide, 4′ 8″ long and 11¾″ deep.

Motor Group

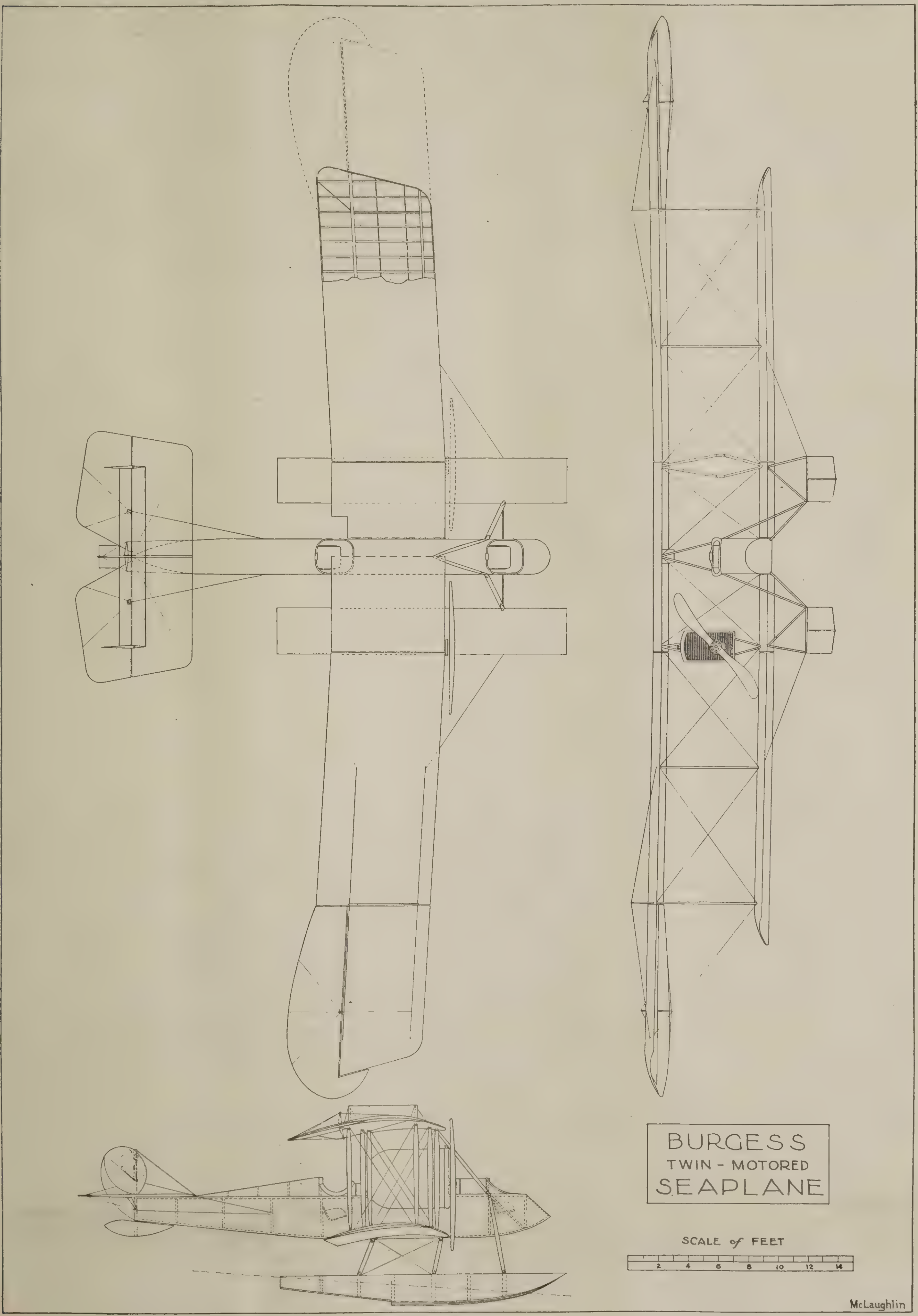
Motor carrying struts are located 11′ 7¾″ apart. The drawing shows the motors covered in with metal cowling. Propellers are 8′ 10″ in diameter, rotating in opposite directions.

The motors are Sturtevant model 5A, rated at 150 H.P. These motors are 8-cylinder, 4-stroke cycle, water cooled, with a 4-inch bore and 5½ inch stroke. The normal operating speed of the crankshaft is 2,000 r.p.m., and the propeller shaft is driven through reducing gears. The weight per H.P. of the motor is 3.4 lbs.

Fuel is consumed at the rate of 26 gallons per hour, and tanks have a capacity sufficient for an eight-hour flight.



The latest twin-motored Burgess Seaplane, at Marblehead, Mass.


BURGESS
TWIN - MOTORED
SEAPLANE
SCALE of FEET
2
4
6
8
10
12
14
McLaughlin

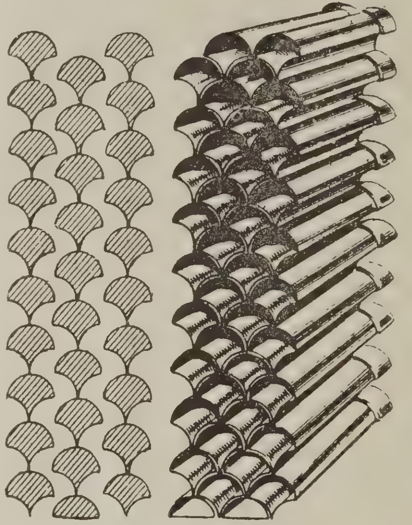
THE GALLAY RADIATORS

WITH the ever-increasing demand for larger and larger engines, power and yet more power, water cooling comes to the fore in the aviation world in much the same manner as it did in the early days of motoring. Already the limiting size of which it is advisable to make an air-cooled cylinder are fairly well defined, and when this has been erached, as it undoubtedly has in several air-cooled engines, an increase in power can only be obtained by a corresponding increase in the number of cylinders. Here, again, the number of cylinders which it is practicable to incorporate has its limitations, whether the engine be of the Vee, radial or rotary type. Logically, therefore, unless some new principle of air cooling, either by a scavenging stroke or other means, is introduced, it would appear that water cooling will have to be resorted to for the high-powered engines with which our pilots will have to be equipped if they are to have a fair chance of meeting the Germans on a level footing—literally as well as figuratively speaking—in the struggle for supremacy.

That a great deal of experimental work will have to be done, in order to determine the best ways and means of effectively cooling these larger engines, goes without saying. Much will yet have to be done in the way of determining how the greatest cooling effect may be obtained with the smallest amount of resistance, and this would appear to be a subject for such an institution as the National Physical Laboratory rather than for a private manufacturer.

In the meantime, the motor-car radiator can be fairly easily adapted for air work, has, of course, already been so in a number of different types of aeroplanes, although we should not like to say that in so doing the maximum of efficiency has been attained. According to present practice there can be little doubt that the honeycomb type of radiator holds the lead, whether it be mounted in the nose of the machine or elsewhere. In the absence of wind-tunnel tests it is difficult to say whether the square tube, round tube or other formations are best as regards the ratio of cooling capacity to wind resistance. At any rate, on the face of it, it would appear that the form, in which the normal area presented by the walls and soldered spaces between adojoining tubes is the smaller, would be the more efficient.

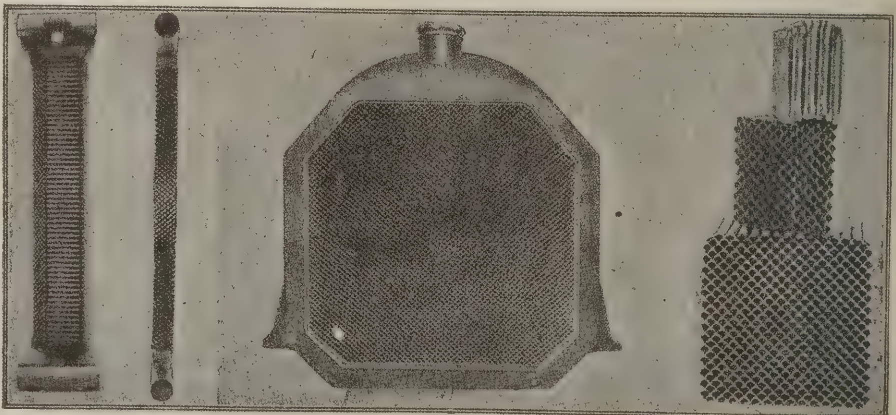
A form of honeycomb radiator which has won great popularity in the motoring world, and which is coming more and more into prominence on modern aeroplanes is the Gallay radiator. A visit to the Gallay works in Scrubbs Lane, Willesden, reveals some highly interesting facts concerning the design and process of manufacture of this type of radiator. This subject is one on which it is at present difficult to say enough and yet not say too much. Many of the most interesting points cannot, for obvious reasons, be touched upon. However, a brief outline of the principal features may be permissible. Geometrically the Gallay radiator is very simple, the water spaces consisting of a series of semi-circles and quarter-circles. Reference to the accompanying illustrations will, we think, make this point clear. Each air channel is formed of an endless strip of brass, or, more correctly speaking, of a strip, the ends of which are folded over and joined on a highly ingenious machine. This strip is then placed in a press, on the design of which, by the way, the firm have spent a considerable amount of time and money. In this press the strips are given their typical Gallay formation, and all that remains to do to complete the honeycomb is to solder the ends of adjoining strips together. Owing to the peculiar shape of the corrugations this is a simple matter, since there is no tendency for individual tubes to slip, a difficulty often experienced with round tube types. The strips are placed side by side in the requisite numbers, and are lightly clamped together, ready for soldering. This is done by "dipping" the ends in a shallow tray in which there is just the right depth of melted solder. When finished, the radiators are tested for leaks, of which very few are found, owing to the initial rigid inspection of the brass bands over a box with glass top and in which are placed a number of electric lights. Even the smallest pin hole is instantly discovered during this inspection, and the possibility of a faulty strip finding its way to the presses is very remote.



Diagrammatic sketch of the Gallay radiator construction.—On the right is shown a section of the radiator with water passages and air channels, while the diagram on the left indicates the method of building up the honeycomb of separate strips

From our illustrations it will be seen that the edge left between adjoining tubes is very thin indeed, and the amount of solder used, although quite adequate for its work, is reduced to a minimum, no superfluous solder being left anywhere. As to the resistance per square foot of this formation no information may be given under present conditions, but some rough and ready tests showed that the tubes obstructed the flow of air to a surprisingly small extent. As already mentioned, this firm are making large numbers of motor-car radiators, all the usual forms, such as flat, rounded and pointed, being possible with the Gallay formation. A point in favor of this radiator is that it can be built up in units or sections of almost any size from a couple of inches square to several feet square. More than that, repairs are quickly and cheaply effected, a damaged section being simply removed and a new substituted, or, if necessary a single damaged tube can be replaced without disturbing the rest.

One of our illustrations shows a new departure in aero-radiator design, at any rate as far as this country is concerned. It consist in building up the radiator of a number of standardized units, in such a manner that, for a given engine, a certain number of units are employed. If the same engine is used on a faster machine fewer units are employed; if on a slower one, more units. This arrangement follows, it will be seen, along the lines of the German Pazet radiator described in *"Flight"* of December 31st, 1915. A few moments of consideration will suffice to show the advantages of this arrangement. Instead of a different size and shape of radiator for almost every type of machine, varying even in the same machine according to the engine fitted, we have with the unit system a standard unit that can be turned out in quantities without thought of the machine on which it is to be mounted, which is merely another way of saying that it can be manufactured economically and, what is of greatest importance of all at present, quickly. To the Gallay Radiator Company belongs the credit of having realized the possibilities of the unit system, and it is to be hoped that the authorities will give this method their serious consideration.



A FEW EXAMPLES OF GALLAY RADIATOR CONSTRUCTION.—On the left is a Gallay radiator of the standard unit type. The necessary cooling area is provided by adding the requisite number of units for the engine and speed in question. For the same engine, if the speed is greater the number of units is reduced, if the speed is smaller the number is increased. The honeycombs are pivotally connected to the top and bottom water leads, so that by suitable adjustment the rear units can be brought out of the path of the front units. The photograph in the centre shows a Gallay motor car radiator. Note the exceptionally "clean" appearance of the honeycomb. On the right are three sections of the Gallay radiator. At the bottom a 6 ft. 6 in. section showing the semi-circle and the quarter-circle formation peculiar to the Gallay radiator. In the centre is a sectional view of the honey-comb, showing clearly the shape and relative size of the water passages. On top is a section of a pointed radiator, lying on its back, in order to show how adjoining strips are staggered relatively to one another to provide the pointed form. This section also shows how the water passages are formed by stamping cut the ends of the tubes bell mouth fashion.

ANTI-AIRCRAFT DEFENSES FOR COAST FORTIFICATIONS

By MAJOR THOMAS ASHBURN, C. A. C. U. S. Army

In the study of such a subject the first step is to determine what types of air-craft will be used, how they will be used, and what purposes they are designed to accomplish.

There are three conditions under which the defenses may have to contend with hostile aircraft.

1. When the fleet has a sufficient number to gain control of the air.

2. When the hostile air-craft are approximately equal.

3. When the air-craft of the defenses are powerful enough to control the air.

Under any and all of these conditions some one of the following objects is designed to be accomplished by the fleet air-craft:

1. To reconnoiter and discover the location of the various elements of the defenses.

2. To control the fire of the enemy's ships against land batteries and defenses, and hostile ships.

3. To bombard.

In these three objects three separate types of machines would probably be used:

For the first, scouting machines of the tractor type, quick acting, capable of a speed of 80 miles an hour or more, unarmored, unencumbered by wireless or guns, carrying not more than one or two passengers who are armed only with a rifle or revolver and provided with field glasses and photographic apparatus.

For the second, heavier and slower machines, capable of furnishing all necessary conveniences to the aviators, of great stability under slow speed, armored sufficiently to resist rifle attack, and fitted with sufficient armament to repel "scout" attacks.

The third class should be speedy, easily maneuvered, all steel covered (if practicable), capable of carrying sufficient guns to meet a destroyer on even terms, and equipped with bombing material.

In the discussion of any project for defense, it is wise to consider that the enemy has been able to limit the defense as much as possible, and to devise ends and means to meet such conditions.

If the lesser unfavorable conditions are actually what occur, so much the better for the defenses; and if the defenses actually gain the supremacy of the air, then a formidable menace is greatly reduced.

We will, therefore, assume that the enemy has gained control of the air, but that the defenses still have a few machines of all types available. This is really a fair assumption, because at the present time our aerial equipment is decidedly inferior to that of any powerful foreign nation, and while Congress appropriated liberally in the last year for aeroplanes, etc., and an organization into units has been started, it will be some time in the future before we can hope to cope in war times with a foreign invader.

Let us consider a defense against the scout type first.

What can a scout do?

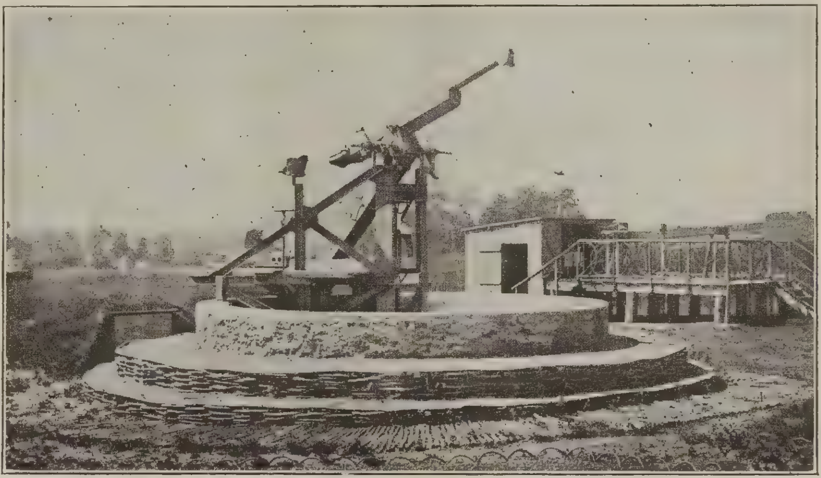
No material damage; for it is a light machine, unarmored, easily handled, and rarely carrying more than two men. It can, however, do very substantial damage in locating the various elements of the defense if unmolested.

How close must they fly to the defenses to obtain accurate information?

Of course that will depend upon the condition of the atmosphere; whether or not there are clouds, rain, snow, or fog.

Colonel Bishop and Lieutenant Robertson flying at 10,000 to 3,000 feet, were not able to distinguish whether a flat stretch of desert was or was not the Salton Sea. True, the air conditions were unfavorable. Under favorable conditions, the least limit to which the scout plane must descend is the distance at which the telephoto-lens cameras make pictures sufficiently clear to be enlarged so as to show the terrain conditions, or where the observer can distinguish clearly enough by his glasses to make a sketch. At the beginning of the war, photographs and sketches were made at distances from 500 to 2,000 feet. The limit at which they are now made is practically 5-6000 feet, but may be as high as 8000 feet and perhaps more. The vision from air-craft, however, is greatly impaired by the slightest haze.

As the limit of the use of the scout has increased, the effective range of air-craft guns, and their handling, has more than kept pace, and today, according to an eminent English authority, and to our own Signal Corps reports, "the development of anti-aircraft artillery has reached a point where it is decidedly uncomfortable for an aviator to fly lower than 10,000 feet." The United States considers that the "safe" altitude is not less than 12,000 feet. The use of aeroplanes at night for purposes of scouting or reconnaissance is so confined that the question of defense against them at night is superfluous, except to keep under cover as much as possible and to use searchlights judiciously.



Anti-aircraft gun used for coast defense

Let us now consider the destroyer class.

Their method of attack against seacoast fortifications is limited to bombing.

According to the very best authorities obtainable, drop bombs are classified as light weight, medium weight, and heavy. The light weight bombs vary from a few pounds to 15 pounds, the medium weight from 15 to 50 pounds, and heavy bombs, which go no higher than 100 pounds in our service, may range as high as 220 pounds. In a few isolated cases bombs weighing as high as 400 pounds have been used. These bombs are undoubtedly designed to detonate upon impact and, while good reasons can be advanced for equipping them with time fuses that would be ignited by the shock of impact, there would be the objection that the bomb would have to be heavier in order to have sufficient strength to resist breaking up on striking and before explosion could take place.

These facts, however, have probably caused the bomb makers to invent a combination impact and time fuse for, of course, the heavier the bomb, the more difficult it is to handle in the aeroplane and also the smaller the number that can be carried.

Everyone has seen an acrobat in a circus drop from the top of a tent into a net, from distances of 50 to 100 feet. The acrobat is thrown up in the air a distance having a direct proportion to the distance he has fallen. It would be an interesting experiment to try a series of rope or wire nets, separated by, say, a foot or so apart, and drop weights, corresponding to bombs, upon them from different heights to see if a series of three or four nets would not stop the weights. If it were found that these nets were capable of stopping the weights, then real bombs fitted with detonators could be tried to see if the bombs would detonate. If the experiments showed that they were successful, all gun emplacements of sufficient importance and other important elements of the defense might be protected from a direct hit by some such means as that suggested.

This proposition may appear absurd on the face of it, and it is not substantiated by any mathematical argument. Nevertheless, the fact remains that there is no case of which there is any record of bombs having fallen in accordance with the theoretical law of faling bodies, or in accordance with preconceived ideas. The very shape of the bomb, the fact that it has to pass through air strata of varying degrees of resistance, the fact that the theoretical law itself may be wrong, certainly leave room for experimentation. Laws deduced by actual experience may safely be assumed to be correct, but who, before the invention of aeroplanes and actual bomb dropping, even had a chance to more than theorize in deducing a law for falling bodies?

The United States military authorities state positively that bomb dropping at altitudes of 6000 feet cannot be carried out with any degree of accuracy. As long as aerial raids can be kept at higher altitudes, they cannot be considered as a serious menace to fortified works. The question for the defense is, then, to provide means of keeping them at least 6000 feet up in the air.

A series of anti-aircraft guns mounted for coast defense

(*Continued on page 934*)

CARBURETOR DESIGN—A STUDY OF THE STATE OF THE ART

By CHARLES EDWARD LUCKE, Professor of Mechanical Engineering

(The following paper was prepared by Professor Lucke for the National Advisory Committee on Aeronautics, and is included in the Second Annual Report of the Committee, together with two supplementary chapters on the subject of carburetion.—Editor.)

Any effort to improve the gasoline engine and to perfect it for use, in aeronautic, marine, and land transportation service, must proceed along a series of more or less parallel coordinate lines of attack, each concerned with some one independent phase of the problem, after a general review has indicated the nature of these subsidiary problems and their relations. Such a general review with special reference to aero engines has already been made and formed the subject matter of the report of last year. In addition to the specific problems of engine design proper, involving arrangement of parts, selection and treatment of materials, and determination of best dimensions for strength or life on the one hand and large mean effective pressures with high thermal efficiency at high speeds on the other, there is another group concerned with what might be termed the engine auxiliary functions. These latter include ignition, lubrication, cooling, and last, but most important of all, carburetion. It is most important because it is concerned with the making of suitable mixtures, without which the engine cannot be a success no matter how perfectly the other phases of the engine problem may be worked out. It bears the same relation to the gasoline engine as steam making does to the same engine, and the carburetor, with its connections by which the result is attained, is just as important to the former as is the steam boiler and its connections to the latter. This being the case, it is logical and proper that this the second report, and the first one following the general review, should be concerned with the carburetor and the problems of its design. The complexity of the problem of carburetor design, from the scientific engineering standpoint as distinguished from the empiric cut and try one, can hardly be over-rated, and the difficulties involved are realized only by those familiar with the question by reason of experience and extended study. It involves not only many unknown facts and relations of the physics of flow of this class of liquids in small passages and of air at variable rates through every conceivable shape of duct and orifice within certain limits of size, but it also requires the crossing of the borderland of knowledge on the physical chemistry of these complex fuels, their vapors, and vapor air mixtures; fuels which are solutions of many and variable constituents, all of them having tendencies under certain conditions to polymize. In addition to these difficulties of a physical-chemical sort, there are involved two other groups, the first being the usual one of structural design, and the second that of definition of the object to be attained. With reference to the latter it must be admitted that there is no convincing experimental proof available from engine tests to definitely establish just what sort of mixtures give the best results in engines; whether, for example, they should be constant or variable in proportions of air to fuel, and whether also they should be dry or wet, and if the latter, how much moisture is permissable and in what form. To be sure, opinions and deductions of some value can be based on indirect observations and on certain principles, but works of importance should be based on proved facts and not of opinions or deductions. Pending the establishment of the required physical-chemical data and the specifications of suitability of mixtures from the engine standpoint, both of which must constitute a separate series of investigation, the problem of carburetor design may be approached with some profit from the qualitative side.

Design of any appliance or machine must be undertaken qualitatively before any quantitative work is warranted, the former being concerned with the form and arrangement of the parts and the latter with their dimensions. Qualitative design, the fixing of the nature and form of the several necessary structural elements and their mutual relation or arrangement, must satisfy ten independent sorts of requirements—first, functional, and second, constructional. With reference to the former it is clear that to make the apparatus work there must be provided certain parts suitably arranged and the selection of such forms and arrangements of parts as would seem to promise the sort of action or function desired, is termed invention when the same thing has not been done before in the same way, otherwise it is merely the first phase of qualitative design. The second or constructional requirement for qualitative design imposes a limit on the first, dictated by the tools and processes of the shop. However nice and proper an appliance or machine scheme may be from the functional standpoint, it is obviously of no value if it cannot be constructed and of little value if the construction is difficult, so as to involve excessive cost, inaccuracy, or some other element of unsuitability.

Quantitative design, the determination of proper dimensions, for the parts as selected and arranged, must also meet two independent requirements, or rather there are two sets of dimensions that must be separately determined because they have different objects. The first phase of quantitative design must fix those dimensions that are concerned with functional operation and directly supplement the selection of form and relation of structural elements, so that not only will the sort of result desired be attained, but also in just the right degree. The second step in the whole series fixes those dimensions of the parts that insure, with due reference to the materials, suitable strength and stiffness to resist rupture and undue deflection, respectively, under stress, and that insure suitable life to parts subject to destruction by wear or corrosion, for example.

Applying these general principles to the case of carburetor design, the first phases of both the qualitative and the quantitative design are of controlling importance; both of the second phases dwindling to almost negligible quantities in comparison. For example, the second phase of quantitative design, the fixing of dimensions for strength and life, is almost, if not quite, eliminated by the fact that the parts of carburetors are subjected to no stresses that cannot easily be resisted by the thinnest metal that can be cast, and that, so far as life is concerned, here is no corrosion with the brasses and bronzes in use. While there is some wear in those carburetors that have moving parts and some permanent set in springs, it also is true that good carburetors need have neither wearing parts nor springs. Again, the second phase of qualitative design, which imposes shop limitations of form and arrangement, requires no special treatment for carburetors over any other device or small manufactured metal product made mainly or wholly of cast metal with some rough and some accurate machining, involving only light cuts and short operations easily carried out with small tools of standard form with special jigs and fixtures or with special tools.

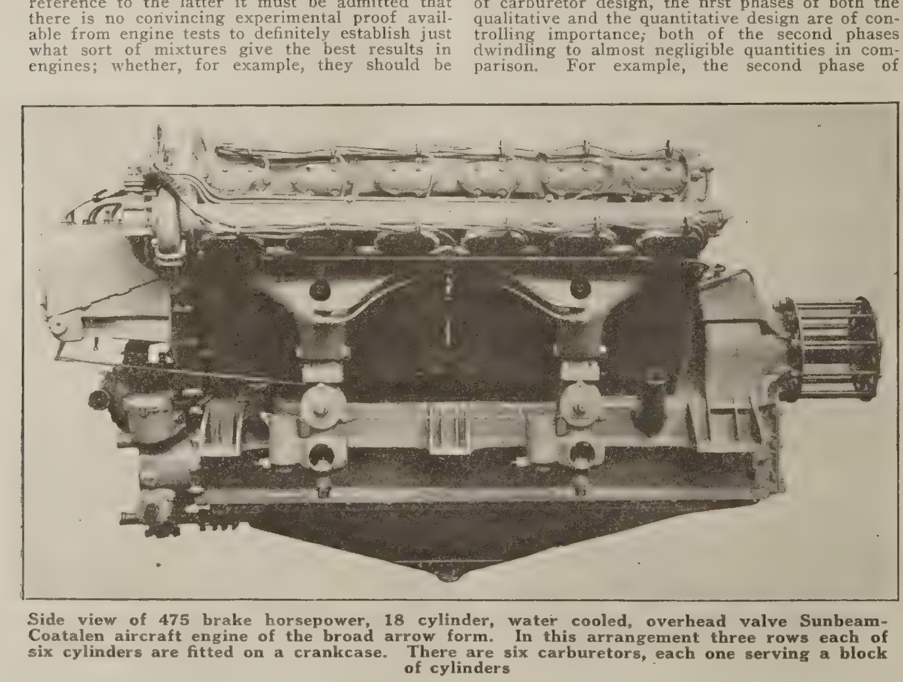
It appears, there, that an investigation of carburetor design must be concerned almost entirely with the first phases of both qualitative and quantitative design, the selection of these schemes of form and arrangement of parts that promise the right sort of functioning and results, and then dimensioning the parts so they will produce the desired kind of result in the required degree. These two steps might well be called qualitative functional design and quantitative functional design, respectively.

There are two good reasons why qualitative functional design should be undertaken before the quantitative—first, because the necessary physical data for the latter have never been determined, only a few isolated facts being available, and second, because the determination of dimensions must necesasrily follow a decision on form, or otherwise the more that form alternatives can be reduced to a minimum, the less is the variety and scope of the pertinent physical data required for application to them.

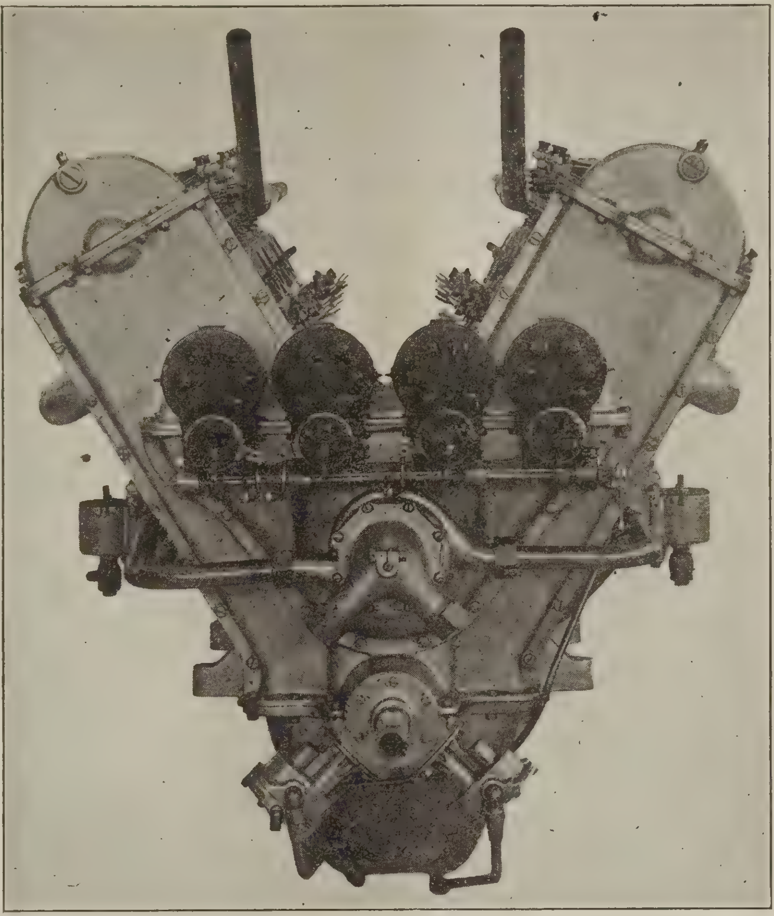
This report is concerned almost exclusively with an analysis of the question of qualitative design, not only because it is logically the first step to undertake but also because its scope is so very wide and the amount of available material requiring review so large as to have taken up all the time available.

Quantitative design has been approached but not actively attacked; only so much has been done in this direction as to point out the need of thorough investigation by showing the importance and the present lack of exact data.

Qualitative functional design of carburetors must begin with an examination of alternative processes of carburetion, and a selection of one or more such processes as seem promising must be made before any attempt is made to scheme out the form and arrangement of the parts that together shall constitute the carburetor. Carburetion as a process is in the broad sense essentially the same as humidification, the former dealing originally only with the hydrocarbon products of petroleum but not with any liquid fuel including the alcohols, the latter with water, and both with vaporization of the liquid in contact with air, the vapors and the air mixing more or less homogeneously. The thermodynamic laws of such vapor-air mixtures as result from carburetion or humidification are pretty firmly established, and the most important of these, with reference to the present object, is that group relating the partial pressures of the vapor and the air in the mixture to the proportions of vapor and air and to the respective molecular weights. In accordance with these relations, a mixture of vapor and air in any desired proportions can be obtained by maintaining an intimate contact between the liquid and the air until such time as saturation results by the building up of the partial pressure of the vapor in the mixture to a value equal to the pressure of saturated vapor corresponding to the temperature. Thus the proportions are determined by the vapor pressure-temperature law of the liquid, by the actual conditions of contact or intimacy between the two, and by the temperature mixture during the time of contact. Of these three factors one is a physical property of a given liquid and the other two represent variables of use, and are subject to control if the apparatus is suitably designed. The vapor-pressure curves of the more common simple liquids have been determined, and for them these principles point directly to a simple and highly effective process of carburetion in definite predetermined proportions, the process being to maintain for sufficient time a close and intimate contact of the air and the liquid, such as may be done by blowing air over, bubbling it through the liquid, spraying the liquid in the air, or stirring and heating the two in a chamber, meanwhile keeping the temperature constant at the value required by the



Side view of 475 brake horsepower, 18 cylinder, water cooled, overhead valve Sunbeam-Coatalen aircraft engine of the broad arrow form. In this arrangement three rows each of six cylinders are fitted on a crankcase. There are six carburetors, each one serving a block of cylinders



The Magneto End of the Wisconsin Twelve

vapor pressure-temperature curve to give the desired proportions.

Such a process of carburization may properly be called evaporative because the proportions are fixed by the evaporative conditions. The liquid vaporizes, and vapor is added to the air until equilibrium is established between the vapor pressure of the liquid, and the partial pressure of the vapor in the mixture in contact with the liquid. This evaporation process of carburization to given proportions is almost ideal where it is feasible, but unfortunately its value is confined entirely to the simple liquids that have definite vapor pressure-temperature relations and the same relations for every part of the liquid. The only liquids that satisfy this condition are those that are single chemical compounds and among the fuels these are bezol and the pure alcohols, the more common fuels such as the impure alcohols or alcohol-water solutions, and all the products of petroleum, including not only the light but the intermediate constituents, do not satisfy the condition for proper evaporative carburization in given proportions by the simple evaporation process. These latter liquids fuels are solutions of many constituents one in the other, each constituent to be sure is a simple hydrocarbon with fixed physical properities, but the solution has variable physical properties. The presence of one substance in solution in another, affects its vapor pressure in a fairly well-known way, but there is no means of predicting what is the resultant of 10 such, each affecting the other. Physical chemistry has not advanced far enough to answer such a question, and it is doubtful if the answer would be of much value even if it could be found in the absence of equally definite, simple, and practical analytical means of identifying and evaluating the separate hydrocarbon constituents of such solutions as the gasolines and kerosenes, which organic chemistry so far has failed to discover. From the practical carburetor standpoint enough is known to definitely condemn the simple evaporative proportioning process without such scientific data, because it is clear that those constituents that have the highest vapor pressures will exist in the vapor air mixture in larger proportions to those that have low vapor pressures, than they did originally in the liquid mass, and that, as evaporation proceeds there will be a fractionation that leaves the heavy constituents behind. The mixtures proportions in such cases will be fixed as much by the ratio of constituents in the liquid as by the vapor pressure of any one—by the intimacy of air contact or by the temperature—but the ratio of constituents in the liquid varying as it does as evaporation proceeds, the proportions of vapor to air in the mixture cannot possibly be controlled automatically by any simple and practical means.

The condenmation of the evaporative means of proportioning as a carburetion process for engine use for all liquid fuels that fractionate at once removes from consideration a very large number of older carburetors designed for and used largely in connection with the manufacture of illuminating or fuel gas for pipe distribution and confines attention to a newer group of carburetors in which the proportions of air to fuel are subject to mechanical control and are quite independent of the constituents of the fuel or their vapor pressures.

Mechanical proportioning is an essential element of any practical carburetion process where complex fuels, like the petroleum distillates, are to be converted into vapor air mixtures in controlled proportions for introduction into an engine cylinder; but, of course, mechanical proportioning does not of itself constitute a carburetion process except under one condition. If the vapor pressure of fuel, or, rather, of its heaviest constituent, be high enough, then mere introduction of the fuel into the air, especially if both be flowing through passages that produce eddy mixing currents, will result in immediate vaporization and the formation of the desired mixture. All the older gasoline of 76 degrees Baumé and upward has this property, so for them a mechanical proportioner that feeds a measured amount of gasoline into an air stream does in reality constitute a proportioning carburetor. The present-day gasolines, ranging but little above 60 degrees Baumé, and in some cases lower, have some constituents so heavy and with vapor pressures so low as to require either special spraying and stirring elements or heaters to produce a suitable homogeneous mixture, the making of which constitutes carburetion. Nevertheless such proportioning devices are also termed carburetors, even though vaporization is not complete, because they produce mixtures on which engines can be operated, and since the proportions are established by a sort of metering action of the fuel by the flowing air, and not by the vaporizing properties of the fuel, they have been named "proportioning flow carburetors" in this report.

For all gasolines, kerosenes, or other petroleum distillates, and any other complex fuel to be used in engines, proportioning flow carburetion processes must displace the older evaporative processes of the gas industry, so attention must be concentrated on the various ways in which the air flowing toward an engine cylinder may be made to proportionately meter, receive, and become mixed with the amount of fuel it can support in explosive combustion quite independent of just what degree of vaporization or just what proportions will work best in a given engine on the assumption that these are independent variables.

The pure case of proportionate flow carburetion is that in which the air flow directly, without the medium or interposition of any connecting mechanism, does of itself induce or produce the fuel flow in amount always proportionate to the amount of air, simultaneously mixing the two or more or less actively with or without the addition of heat. This process depends upon the laws of flow of air and of liquid fluid, relating rate of flow to pressure drop of flow head, and, in general, it assumes that the suction stroke of an engine piston establishes a vacuum of some degree in every portion of the air entrance passage, which vacuum varies regularly with the quantity of air that will flow under its impelling influence. It also assumes that if from a supply of fuel at a constant hydraulic head a connection be led to a fuel nozzle somewhere in the air passage, the static head with reference to the nozzle being ideally zero, then no fuel will flow unless air is also flowing, because of the common vacuum relation, and fuel flow will increase with air flow as the vacuum increases. For such double flow to be truly proportionate and in constant ratio it is clear that both the liquid and the air flow must follow similar physical laws and that the weight of each must bear the same algebraic relation to the vacuum that is responsible for the flow. In the absence of a pair of air and fuel passages of such form and relative disposition as would have similar flow laws, then some means of automatic correction of the proportions become necessary to restore the desired ratio and to maintain it, no matter how the rate of flow may vary, so as to satisfy the demands of engines operating at variable speed and load.

Between these two basic processes of carburetion—the "evaporative" and the "proportioning flow"—there may be found a series of minor alternatives, or special modifications, some of them standing more or less apart and others lying midway between and involving both to an equal degree. As an example of the latter a truly evaporative carburetor of the tank and wick type may be modified by feeding fuel to the wick by a proportionate-flow device instead of allowing the wick to pick up and feed fuel from the tank by capillarity. Evidently an apparatus of this sort might be classed under either process. If the proportionate-flow feeder were so regulated that no fuel accumulated on the wick or in the wick chamber, then evaporation does not fix the proportion, but the proportionate feeder does, and the device is a proportionate-flow carburetor. On the other hand, if the proportionate-flow feed delivered an excess of fuel over what could be carried off by the air passing the wick, some fuel would accumulate on or about the wick, and the proportions of the delivered mixture would be fixed by the evaporative and not by the proportionate-flow elements, and the device would be an evaporative carburetor. Fortunately, such cases as this are rare, or there would be more confusion than now exists. There is generally no difficulty in interpreting the action of a given apparatus, or, to state it otherwise, there are very few cases where the basis or principle of proportionality depends on the rate of feed, the adjustment or other operating conditions, within the working range.

Another sort of mixed process is that of direct injection of fuel by a pump into the air, the pump being driven by the pulsations of the air pressure in the intake passage or by the engine directly, and the delivery of fuel being made into the air on its way to the cylinder through the intake passages or directly into the cylinder after the air has entered. These are not regarded as proportionate-flow processes, because in general there is no definite proportion maintained; but also because the air-flow rate is not of itself responsible for the quantity of fuel fed. If a constant-speed engine cylinder took the same amount of air every stroke and a pump, driven from the air pulsations or from the engine, delivered the same amount of fuel at the same time, then the fuel and air quantities would clearly be in proportion, fixed by the displacement of the main piston and pump plunger, respectively, with corrections for volumetric efficiency. While this constitutes one series of mechanical proportioning means, the cases are special, as also is the engine-operative condition of constant speed and load, to which they are applicable. All direct-injection engines with or without compressed-air sprays constitute a quite independent class, characterized by mixture making directly in the cylinder and have practically nothing in common with the carburetor class of engines making mixtures externally. Pump deliveries to carbureting chambers in the intake passages, when the pump is driven by the engine, or in fact, in any way except by the movement of the entering air, are excluded from the proportionate-flow class because the flow is not essentially proportionate. They constitute an additional class between the truly proportionate-flow and the direct-injection classes.

When the air flow actuates an air motor-equivalent to an air meter and this motion in turn actuates a fuel pump, then the combination is truly a proportionate-flow carburetion system, operating on a constantly metering volume ratio at all rates of air flow, and in all respects equivalent to the vacuum-controlled flow of the two fluids through two separate passages to a common point of mixing.

With this general review as a basis, the search for possible forms and arrangements of parts making up the carburetor proper to operate under the process of proportioning-flow carburetion may be undertaken, and all the available suggestions for the construction of proportionate-flow carburetors collected and compared. This comparative study of the qualitative design of proportioning-flow carburetors must begin with the collection of examples from any source, which must then be grouped into typical classes on the basis of functional or structural similarity, so that class may be compared with class before any attempt to analyze differences of detail within each class.

The best source of information for this purpose is clearly the Patent Office record of inventions, and this has accordingly been made the basis of the study which constitutes the bulk of this report. From the official classification list and the definitions of each official class and subclass a selection was made of those that seemed likely to contain patents on carburetors. To assist in this work of discovering the carburetor patents of the United States the services of a competent patent lawyer were enlisted, and under his direction searchers were set to work in the Patent Office, where, aided by its officials, a list of United States carburetor patents was prepared and copies collected for study and comparison. The detailed steps by which this list was made and copies of each patent secured are given in Part II, with the patent number, date, title, and inventor's name, arranged according to the official classes, subclasses, and cross references.

Having secured copies of these patents, which numbered, after eliminating duplicates, about 3,400, a surprisingly large number in view of the fact that the art is comparatively a new one, every patent was read and reclassification begun as a basis for the comparative study. The first step in this reclassification divided the patents into the two groups of "proportioning-flow carburetors" and "other subjects," the latter including parts, attachments, complete engines, injectors, and all "evaporative carburetors." This made about an equal division and incidentally brought out the interesting fact that practically all the older carburetor patents are evaporative, while practically all the recent ones are proportioning flow as to broad process, the latter beginning about the year 1900 but not becoming really numerous until about the year 1910. This shows that the proportioning-flow carburetor art is about 17 years old, the official life of a patent, and that, therefore, most modern carburetors fall within the patent life and must be either themselves the subject of an active patent or similar in some respects to the disclosures of one or more such patents.

Following this division of United States carburetor patents into "proportioning-flow" cases and "other subjects" the former group was studied for the purpose of subdivision into classes according to some rational basis of similarity. This step brought out the fact that the present official classification is not a good one, so deficient in elements of distinction as to make necessary the creation of a new classification before any comparative study could be made at all. This new classification has been worked out and the "proportioning-flow" carburetors assigned to places in it in Part III of this report. The very great labor involved in reading, reclassifying, and comparing these thousands of patents in the limited time available has probably led to some errors, which can only be removed by a subsequent checking, but it is believed that the results reported are correct in the main and mistakes are confined to individual cases. To make this sort of study quite complete and of the utmost practical value, not only to designers but also to patent lawyers interested in soliciting new patents or in litigations over existing ones, the new classification and relisting should first be checked and later extended to include the cases of the leading foreign patent offices. It is hoped that the value of so doing will seem to parties interested great enough to have the required funds made available.

Following the reclassification and relisting of the United States proportioning-flow carburetor patents the general characteristics of each new class and subclass is given and structural variations within each class illustrated by photographic reproduction of the drawings of typical patents, the number of which so reproduced is about 450. This illustrated review of the functional and structural characteristics of proportioning-flow carburetors is the subject matter of Part III of this report, which brings out a most amazing wealth of material as to form and arrangement of parts. Even a brief review of this section of the work will convince the most skeptical that so far as qualitative design of proportioning-flow carburetors is concerned there is little to be desired, and that whatever may be lacking in carburetors or carburetor design is mainly quantitative in character. An effort is made in this comparative study of functional characteristics of the new classes and subclasses to point out the most promising ones from the standpoint of automatic proportioning at any rate of flow, so as to stimulate inventive and designing effort in this direction. Concentration of thought along the more promising lines should result in greater and more rapid advance and perfection of the needed appliances than the scattering of the same effort over the whole field, which includes some types or classes of very much less promise. Of course it is hardly to be expected that there will be a general acceptance of the guides offered, especially among inventors interested in what have been reported as the less promising groups, as the inventive mind normally resists guidance. However this may be, it is hoped that this, the first systematic effort to bring some order into what has been a most chaotic situation, will bear sufficient fruit to justify the serious painstaking labor that has been expended.

No arrangement of parts intended to act as a proportioning-flow carburetor can be conceived that does not involve some mental assumption of a law of flow for the fuel and for the air, relating rate of flow to pressure drop or vacuum. Therefore in every one of these many hundreds of patents there is indirectly involved some such assumption by the inventor, either consciously on unconsciously. With only a few isolated exceptions, not one of them gives any inkling of what flow law is assumed to hold in his device, although nearly all assert their object to be the production of a device that either holds their proportions constant under all conditions or gives some specific sort of control over proportions. In some cases it is quite clear that there is no understanding of the general principles of fluid flow at all, while in others the principles have clearly served to guide the design which, therefore, is at least qualitatively correct and requires only the application of the numerical values in the flow equations to its dimensions to be quantitatively correct also or which can be made correct experimentally without solving the equations numerically. One pretty common violation of the principles of flow for air is neglect of its critical pressure drop limit, acording to which no increase of air flow through an orifice takes place after the pressure drop through it exceeds a given value somewhere about four-tenths of the absolute pressure on the supply side. This becomes a most serious interference with proportionality when it is remembered that it does not apply to the liquid orifice acted upon by a similar pressure drop, so that however regularly the air and fuel may increase together as pressure drop increase from zero there comes a time when the air flow ceases to increase while the fuel goes on. Other violations of a general character include the implied assumption of a constant coefficient of efflux for both fuel and air orifices, which may actually vary 100 per cent, also neglect of the differences between capillary and orifice types of fuel passages and the effect of the pressure drop itself on the law of flow for a given passage.

Without undertaking any new experimental determinations of the flow laws and their coefficients for air and gasoline in passages of the forms and size appropriate to carburetors, it is important that the known principles and facts on the subject be reviewed for two reasons, first to indicate the extent of the justification for the implied assumption of some sort of flow law in all of these inventions, and second to clear the way for such new experimental determinations as may be necessary for undertaking their quantitative design on a natural basis. This review of existing flow laws and flow data forms the subject matter of Part V of this report and proves beyond question that present knowledge is wholly inadequate, and that new experimental determinations must be made just as soon as possible.

(To be continued)

MILLER "DOUBLE FLOW" POPPET VALVE

Miller "Double Flow" Poppet Valve

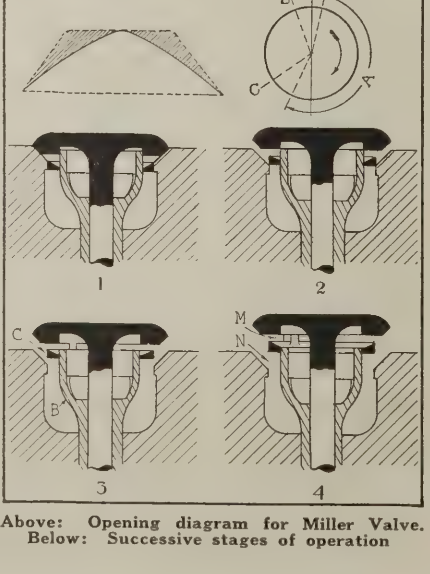
R. Miller, secretary of the Reliance Motor Boat Co. of New York, has designed a modified form of poppet valve, which permits of very rapid opening and closing, thus increasing the capacity of the valve for passing gas. The valve consists of a standard poppet valve having a short skirt on the periphery of its head, separated therefrom by a couple of short bridges so that there is a clear passage between the skirt and valve head. The skirt registers with a sleeve on the upper end of the valve stem guide and also with the lower edge of the valve seat.

Considering an inlet valve, the action is as follows: During the compression, explosion and most of the exhaust stroke the poppet valve head is down on its seat, which is ground. About 30 deg. before the end of the exhaust stroke the cam begins to lift the valve head off its seat, and this lifting may take place as gradually as may be desirable for silent operation. No flow can take place until the upper edge of the sleeve B and the lower edge of the skirt C become uncovered. These two actions take place simultaneously as shown at 2. At this moment the piston in the cylinder is about to begin its suction stroke.

At 3 in the illustration the valve is shown lifted 1/16 in. higher than at 2. (The drawing is somewhat reduced from the original.) The arrows show the double flow, through the skirt and around same. It is claimed that an equal amount of gas flows through both passages. At 4 the valve is shown fully lifted. The closing operations are in the reverse order.

The advantage of this valve construction lies in the fact that it gives a better timing for the flow. Usually the inlet period extends over 100 deg. of the cam revolution, and for quiet operation it is necessary to spread the lifting over 40 deg. and then closing the same, leaving the valve fully open for only 20 deg. If steeper cams and stronger springs are used to open and close the valve more rapidly, the valve action will be noisy.

It is claimed that with the double flow valve the mean opening area for the duration of the opening can be made more than 50 per cent greater, and that even more valve area can be secured than with multiple valves in I or L-head cylinders of the shapes and with the valve sizes and lifts now common. The complication of the valve and its increased weight are, of course, disadvantages. It also appears questionable whether the valve would be capable of giving reliable service as an exhaust valve, owing to the extreme heat to which the sleeve and skirt would be subjected, with practically no means for carrying off this heat.



Above: Opening diagram for Miller Valve.
Below: Successive stages of operation

Des Lauriers to Build Large Factory

Des Lauriers Aircraft Corp. has rented a factory in Newark, N. J., in which it will do assembling work. The building consists of a three-story structure, 200 by 400. The company has also purchased a 6-acre plot, on which will be erected immediately one-story buildings, to be used as a main manufacturing headquarters.

New Herschell Spillman Factory

Herschell Spillman Co., North Tonawanda, N. Y., has a new concrete building under construction, 60 by 175, three floors of which will be added to the regular factory, while the first floor will be made into a test room for motors.

Splitdorf Retires From Starter Field

Newark, N. J.—The Splitdorf Electrical Co. of this city, a pioneer in the manufacture of ignition apparatus for automobile engines and which during the past several years has also produced starting and lighting outfits, including a system adapted for the Ford car, has decided to retire from this field and to confine its efforts in the future to the production of ignition equipment. During the past year the company had two important contracts for lighting and starting equipments, and service for the equipments in the hands of users will be continued, but no new contracts will be taken. The company has recently been going in strongly for the ignition equipment of airplanes, and many of the airplane engines now produced in this country are equipped with its magnetos. The Splitdorf line henceforth will include magnetos, timers, plugs, coils, switches.

AT THE MILAN AERO SHOW

By T. S. HARVEY, in the Aeroplane, London

ALL but two of the twenty Hun engines at the Milan Show are shown unmounted. One of the two, a Daimler, is on the Aviatik (No. 76 in "La Guerra"), a machine which was repainted and flown by Baraca till a stop had to be put to the confusion resulting therefrom. The other is on a much done-in machine and not identifiable.

Motor beds seem mostly of wood reinforced at the angles by steel corner pieces. The excessive number of cylinders, bolts, and everything dismountable, on both and every side or end, speaks of method run mad or intense stupidity. The use of different colored wires, H.T. wires from magnetos, is much to be desired, too.

The workmanship of the small "running-repair mechanic" appears bad. I noted, too, very few of the original magnetos on the engine, possibly because of the sea water in which so many of the machines took their last dip. Radiators, when present, are small, so presumably cooling is ultra-efficient. Every tube and pipe is swathed in felt, asbestos, etc.

The Hiero Motor

Very battered and worn were the Warchalowskis, and the Hiero, their cousin, while the dozen Austro-Daimler and Mercs, ranged from engines of 1913 to a new Merc., modified internally, No. 25076.

The following description of the Warchalowski applies to the Hiero apparently, a more modern and ear-soothing name chosen by Warchalowski and Tissler and Co., of Vienna, for much the same motor. [The name came, one believes, from the fact that the engine was designed by Hieronymus, the famous driver of racing cars,—Ed.]

These engines seem to have been mostly fitted to seaplanes. The 215 h.p. is obtained from six cylinders set separately, three by three on the crankcase, to which they are attached by big wing-bolts.

Between the third and fourth cylinders passes a vertical shaft which drives the overhead valve cam-shaft the two mags., and the pumps. Independent dual ignition with two plugs per cylinder, half compression actuated by forked lever displacing a cam-shaft, and an inspection window in the crank-case, are good points. The motor, owing to the space occupied by this vertical shaft, is very long.

The Hiero has a hefty trumpet-shaped expansion chamber into which the burnt gases are led by the normal exhaust pipes. There is only one other "silencer" in this part of the show, and, perhaps, in the whole exhibition.

The "Rapp," of which there are two examples, is a six-cylinder two by two water-cooled 165 h.p. vertical, with overhead camshaft of early date. Two magnetos, a carburetor "Zenith Vergaser," and a crude but no doubt effective silencer are fitted, and the use of semi-ellipitical six-leaf springs for the valves is a feature.

The outstanding feature among the power plant at the Show is the omnipresence of the 6-cyl. vertical engine. There is not a single example of any other type among the 20 odd captured Hun motors, and among the new Italian-built engines exhibited the exceptions could be counted on one handful of fingers.

The Aeroplane Exhibit

The "Italian Military Aviation" exhibit, in a large tent-hangar, is composed of about twenty different motors used by the Aero Corps since the very beginning till to-day, and is about as instructive an exhibit as man could hope for. It ranges from an immensely ancient Wright 30-h.p., with a 4-cylinder vertical water-cooled car type, to a large Salmson and a Spad with an open V, Hispano-Suiza through horizontal Darracqs, and every kind of exciting and mischief-bringing contraptions, such as one knew in the good old days when a city could be wrought to enthusiasm by a long hop.

I noted a 4-cylinder Colombo, a water-cooled car type, which did good service in early days, and has now developed into a 6-cylinder, much used at the front on Savoia-Farmans, and of which the Bianchi firm are, I believe, the builders by license.

Sectional view of the Italian F. B. A. Flying Boat

Nor is the V motor much in evidence with the exception of a very big 12-cylinder Nagliati, on Renault lines, to all appearances, and of the performances of which, if any, I can say nothing.

The Isotta-Fraschini and Fiats stand out, of course, being engines now fitted to the greater part of the aeroplanes built by the Caproni, Pomilio and Fiat concerns among many others.

Their general lines are familiar to everyone, as both rely on perfection of normal practice by attention to detail rather than on any distinctly original feature. The Isotta-Fraschinis, whose designs are, I believe, Government property, are also built by several of the better known car firms, and by the big firm of Tosi at Legnano. A beautifully sectioned engine of this build was shown, each cylinder of which was shamelessly laid bare from a different point of view.

A big 8-cylinder, on the same lines, was to be seen mounted on the central body of a 600-h.p. Caproni triplane.

The later 250 Fiats were not exposed, being, I gather, more needed elsewhere. According to D'Annunzio, it is a "God-motor." Anyway the Show expressly proclaims itself not "up-to-date."

In dealing with the more recent part of the Show, and some accessories of the myriads exhibited, I feel bound, in gratitude to the designer, to begin by naming the ever-popular Nieuport, a "Baby," which MM. Macchi, of Varese, were showing, presumably, merely not to be absent. A view of some of their other products would prove of interest. Luckily for the Allies the firm's output more than suffices for the needs of these evil days.

Next to them an unwinged Pomilio was well attended to by a show-woman, and drew a throng.

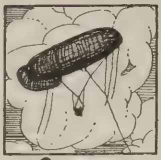
The Societa Anonima Meccanica Lombarda, of Monza, and elsewhere, had a neat school biplane with their own 150-h.p. vertical 6-cylinder (a motor on standard lines). The machine has dual-control and plenty of surface; a type which is much used officially. The many merits of the S.A.M.L.'s other craft are best left alone at present.

Models of a "cruiser" by Frattini—held, *on dit,* in much esteem, and, hence, to be passed over—and of a biplane, designed by Engineer Darbesio, of the "Asteria," and a real pioneer, attracted the eyes of the "*conoscitori.*"

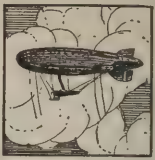
A wonderful collection of Service photos, doubtless of supreme value in their time, were there for the conversion of the hard-hided, and the instruction of the half-baked. Exhibited by the squadron which obtained them, each collection is a document of the prowess of the men belonging to it.

(*Continued on page* 933)

Side view of the Italian F. B. A. Flying Boat



MILITARY AEROSTATICS



An Excellent Ballooning Record

In seven short years Ralph H. Upson has demonstrated his ability on many occasions as a pilot of lighter-than-air craft. Since his graduation from Stevens Institute of Technology, in 1910, he has been constantly associated with all types of aircraft, and is literally at home when in the air. In 1913 he disposed of all aspirants at the national elimination contest at Kansas City, and a little later captured the James Gordon Bennett trophy at the International Balloon Race at Paris, and with it the world's championship, which title he still holds.

Ralph H. Upson

During our late Mexican trouble he operated a kite balloon with the Ohio Field Artillery, on the border. He was the official pilot in the government dirigible tests made at the aviation field of The Goodyear Tire & Rubber Company, and in addition to the government trials made a wonderful unofficial flight from Chicago to Akron, over a 320-mile course, the longest dirigible flight ever accomplished in America.

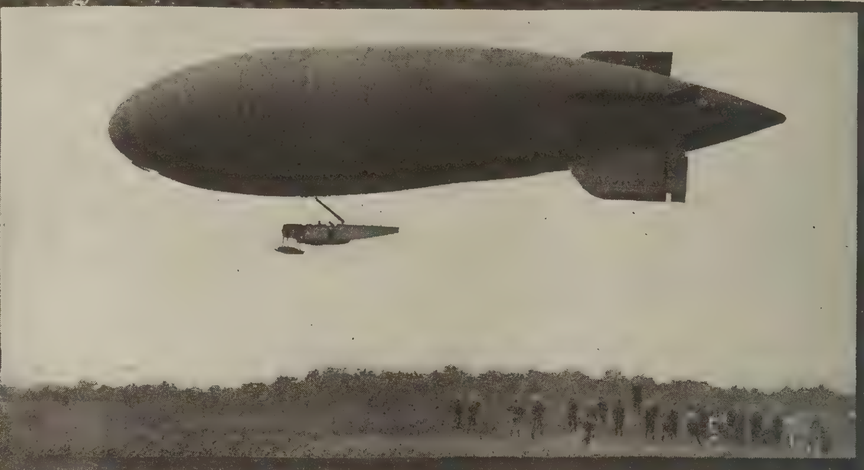
Trials of Goodyear Blimps

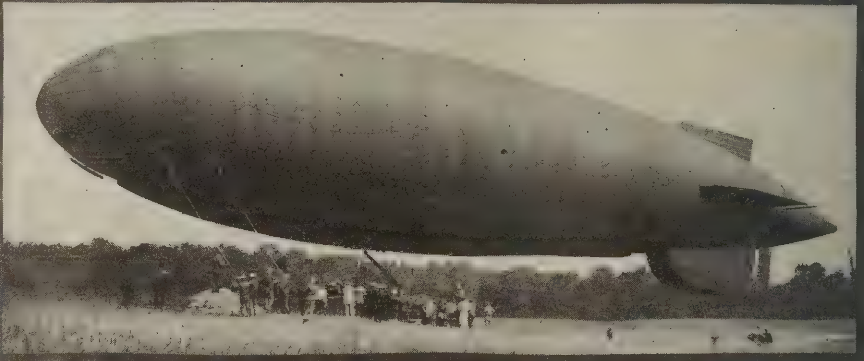
The official trials of the first of the government's sixteen dirigibles now building by the Goodyear Tire & Rubber Company, were watched by United States Navy Officials. The airship in the upper picture is shown making its speed test. Contract requirements were comfortably exceeded. Observe the relative smallness of the car when compared with the gas envelope overhead.

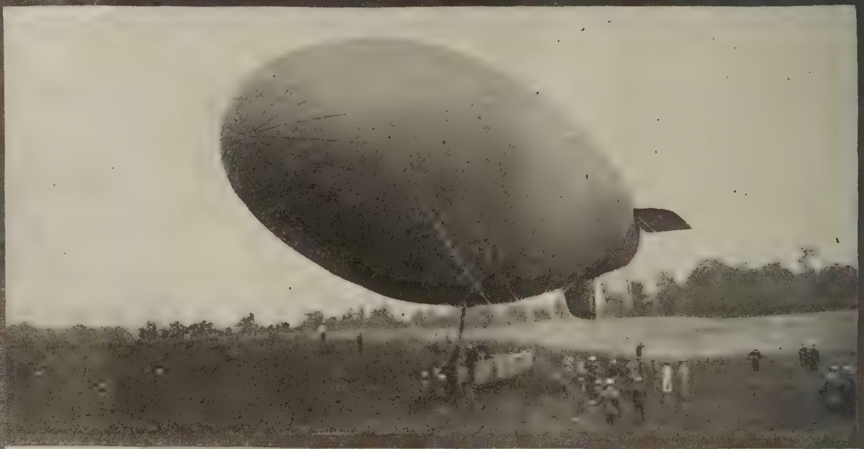
The second upper picture shows the officials inspecting the Curtiss car which propels the big envelope through the air. The pilot operates the rudder and elevator controls, guilding and elevating the bag in much the same manner as an aeroplane pilot shifts his planes from one position to another. The gas bags are made of rubberized fabric of light weight but tremendous strength. With a full complement of these big eyes our navy will soon be equipped to patrol our chief Atlantic ports.

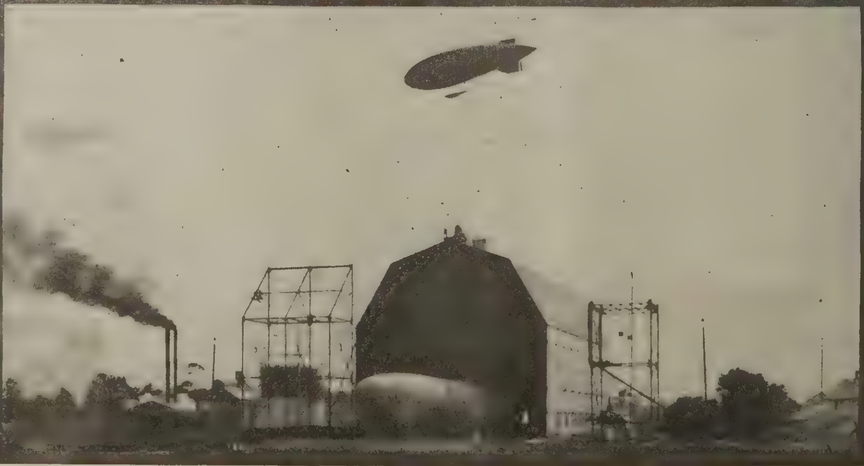
The illustration second from the bottom shows that preparatory to making a flight the big airship is towed from the hangar to the adjacent flying field by a bunch of Uncle Sam's blue-jackets, who have been detailed to the aeronautical section of the navy. At the cry, "Hands Off," the rope holds are relinquished and the big envelope, propelled by the car suspended underneath, gracefully sails out over the field.

The lower picture shows the hangar which is designed to accommodate three dirigibles. In addition to the one shown passing directly over the hangar, one is anchored at the right of the entrance, while still another is being pulled out for a flight. The power plant at the left of the picture furnishes power and light for the aviation camp and generates hydrogen gas for the big bags of the dirigibles. Observe the lookout posted on the hangar.









FOREIGN NEWS

BELGIUM

The Belgian official communication as issued through the French War Office, on Aug 20th, reads as follows:

"On the nights of the 17th and 18th, on the left bank of the Yser and St. Jacque Capelle, the aviation service showed great activity despite the continual barrage of the enemy, operating in dense formations. We executed numerous missions above the enemy lines. On the 16th, Sub-Lieutenant Thieffry brought down his seventh German machine."

Many tons of bombs were dropped on the nights of August 18-19, by the Naval Air Service on the following military objectives: St. Pierre station and sidings, at Ghent, Thouront station and dump, Bruges dock.

A raid was also carried out August 19th on the Snellegham aerodrome, where a direct hit was made on a large shed.

On their return the British machines were attacked by hostile aircraft, which were beaten off with the aid of a Royal Flying Corps patrol. One enemy machine was shot down out of control. All the British machines returned safely.

The important submarine base of Zeebrugge and other military objectives in Belgium were attacked again on August 22, the Admiralty announces.

"A bombing raid was made by naval aircraft on Wednesday morning on the Zeebrugge mole, shipping and batteries," the statement says. "Some hits were obtained. The Ghistellas aerodrome also was bombed. There were explosions near the western shed and a fire was started. All the machines returned."

FRANCE

Incendiary bombs dropped by two German aviators on two hospitals behind Verdun on the evening of Sunday, August 19, killed ten wounded men, one woman nurse and nineteen male nurses. They wounded forty-nine male nurses and inflicted further injuries on patients suffering from wounds received in battle, many of whom rushed into nearby fields in an attempt to find shelter from the bombs which were being rained down.

Meanwhile the German aviators circled about in the air for half an hour, firing their machine guns at hospital orderlies who were endeavoring to extinguish the flames. The nurses had just finished bandaging 180 wounded Germans who had been brought direct from the battlefield, and had gone to bed when the bombs were dropped from a height of only 300 yards. The Red Cross signs were painted prominently on the roofs and the Germans knew of the hospital, which had been in existence for more than a year.

One of the hospitals behind Verdun on which German aeroplanes dropped incendiary bombs recently is at Vadelaincourt. The fire caused by the bombs spread rapidly to the whole building, and the glare showed up more plainly than ever the large red cross painted on the roof. The aviator threw a second bomb, which demolished a pavilion in which were three crews of surgeons who were performing operations. The surgeons, nurses and wounded were obliged to quit the building.

At about the same time a German aviator attacked the hospital at Château Mont Hairons. The bomb exploded in a ward filled with wounded men, killing one of them.

Ten wounded soldiers were killed on the same evening at Belrupt by a German shell.

Proof of premeditation on the part of the German authoriites in making these attacks is furnished by a photograph found on a German aviator brought down at Dead Man Hill. The photograph represented the Vadelaincourt hospital, with the Red Cross sign indicated clearly.

Corporal Oliver Chadwick, of Lowell, Mass., a member of the French aerial squadron, was killed in an air fight over Belgium, it was officially announced on August 22. Chadwick had been previously reported missing.

Chadwick is the eighth of the American aviators serving with the French army to be killed. Thus far the Americans have brought down fifty-eight German machines.

Julian Biddle of the Lafayette Aerial Squadron was killed in the service two days ago.

It is now learned definitely that Corporal Harold Willis of Boston, who has been missing for several days, was brought down inside the German lines by a German machine.

The Lafayette Squadron, composed of American airmen enlisted in the French aerial service, was cited in army orders on August 23 for its courage and spirit of sacrifice. The citation, which is signed by General Pétain, commander in chief, follows:

"The squadrilla composed of American volunteers who have come to fight for France in the pure spirit of sacrifice has fought incessantly under the command of Captain Georges Thenault, who formed it for an ardent fight against our enemies. In very severe combats it has paid the price of serious losses, which, far from weakening, have increased its morale.

"The squadrilla has brought down twenty-eight enemy aeroplanes. It has aroused the profound admiration of commanders who have had it under their orders, and also of French squadrillas which are fighting beside it and have desired to rival it in valor."

GERMANY

A statement issued in Berlin in regard to the latest attack by airships on the northern coast of England says bombs were dropped with good effect on British naval forces. The statement supplements the official report on the raid, in which the loss of one airship off the coast of Jutland is admitted.

Berlin, Aug. 23, (via London)—In an aerial attack yesterday on the British coast military establishments at Margate, Ramsgate, and Dover were bombarded successfully, the War Office announces. In numerous aerial engagements the German shot down three aeroplanes. Two German machines have not returned.

Official announcement was made in London that ten German aeroplanes had dropped bombs on Dover, Margate, and Ramsgate. Eleven persons were killed and thirteen were injured.

A despatch from Vevey, Switzerland, says the barns of the Zeppelin works at Friedrichshaven are being used for the building of a new type of aeroplane from which much is expected. The body of the machine is serpentine in form, and from both sides of it smoke clouds can be thrown out which will entirely conceal the machine.

GREAT BRITAIN

British light naval forces destroyed a Zeppelin airship off the Jutland, Denmark, coast, says an official communication issued on August 21.

The communication adds that there were no survivors from the crew of the airship.

A total of seven hundred and thirty-four persons have been killed in twenty-eight German air raids on England, it was announced on August 23, and 1,565 have been injured.

Of the latter thirteen received their injuries in the latest raids on the 21st and 22nd, when eleven were killed.

Eight of the ten German aeroplanes that took part in the latest raids were brought down by British anti-aircraft guns.

The latest report on the raids, issued by the Admiralty, says:

"Ten enemy aeroplanes of the Gotha type were attacked by naval aeroplanes in the vicinity of Ramsgate between 10 and 11 a. m. August 22. The enemy machines, which were flying at a height between 11,000 and 12,000 feet, were closely engaged, and in addition to the two mentioned by Lord French in the earlier communication, another was shot down by a Royal Naval Air Squadron machine close to the coast.

"The remaining seven Gothas returned seaward, followed by numerous naval aircraft.

"The pilot of a royal naval air squadron aeroplane, which chased the raiders oversea, reports that after firing 300 rounds of ammunition into one of the enemy machines both gunners appeared to have been killed. There was no fire in reply, even at twenty yards distant.

"Another of our patrols of ten machines engaged a flight of about twenty-five enemy escorting scouts, which were off the coast awaiting the return of the enemy bombers, and in the ensuing fight five enemy aircraft were sent down completely out of control, and probably some more, but in the close fighting accurate counting was impossible. All of our machines returned safely."

HOLLAND

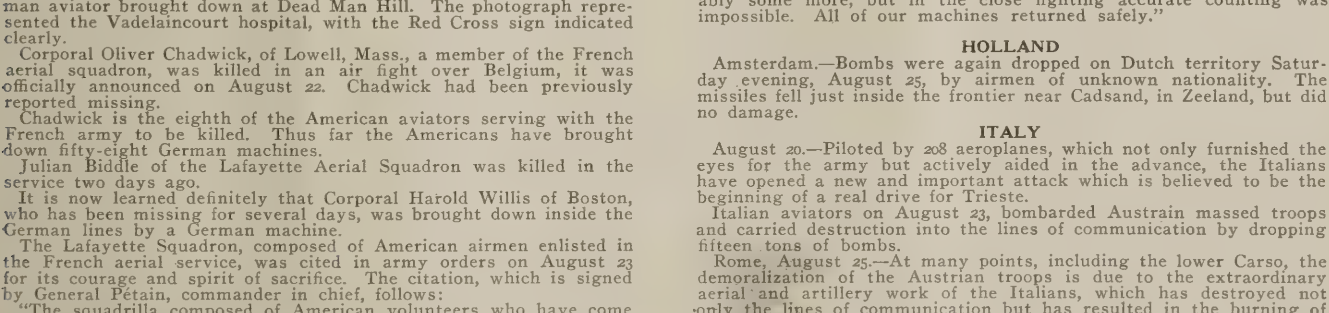
Amsterdam.—Bombs were again dropped on Dutch territory Saturday evening, August 25, by airmen of unknown nationality. The missiles fell just inside the frontier near Cadsand, in Zeeland, but did no damage.

ITALY

August 20.—Piloted by 208 aeroplanes, which not only furnished the eyes for the army but actively aided in the advance, the Italians have opened a new and important attack which is believed to be the beginning of a real drive for Trieste.

Italian aviators on August 23, bombarded Austrain massed troops and carried destruction into the lines of communication by dropping fifteen tons of bombs.

Rome, August 25.—At many points, including the lower Carso, the demoralization of the Austrian troops is due to the extraordinary aerial and artillery work of the Italians, which has destroyed not only the lines of communication but has resulted in the burning of all the main food supply stations of the Austrians, who have been starving at many points between Tolmino and the sea.



Front view of one of the H. and M. Farman aeroplanes described in Aerial Age last week

MODEL NEWS

Edited by G. A. Cavanagh

CLUBS

THE AERO SCIENCE CLUB OF AMERICA
29 West 39th St., New York City
PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
LONG ISLAND MODEL AERO CLUB
401 Grant Ave., Cypress Hills, L. I.
BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
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931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md.
NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
DENVER MODEL AERO CLUB
2820 Raleigh St., Denver, Colo.
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
TEXAS MODEL AERO CLUB
517 Navarro St., San Antonio, Texas

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
PLATTSBURG MODEL AERO CLUB
c/o James Regan, Jr., Plattsburg Barracks, Plattsburg, N. Y.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.

Illinois Model Aero Club News

Another world's record has been broken! Sunday, August 12, at Lake Calumet, Bruno Likosiak's twin-propeller hydro-aeroplane model flew for 118 seconds. This breaks both Ellis Cook's record for twin-propeller models of 100.6 seconds and Lindsay Hittle's remarkable tractor hydro record of 116 seconds.

Other contestants in the meet had fairly good success with their models; three of them making flights of over 80 seconds. The complete repoort of the meet is as follows:

Name.	1st.	2nd.	3rd.
B. Likosiak	112.4	118	..
D. W. Pease	78.8	89.2	3
Wm. Sprague	82.4	8.4	67.8
Wm. Schweitzer	88.4	3	62
P. Breckenridge	..	..	..

For some reason or other, Breckenridge's tractor failed to fly well. The flights were timed and recorded by Walter L. Brock, Consulting Engineer of the Aero Club of Illinois. Another meet is to be held on the 26th of this month, when it is expected that still greater durations may be made.

A Wireless-Controlled Model Dirigible

In our issue of August 13, we described a dirigible made by the Aero Company, from which a parachute was automatically released. Since that time, however, we have discovered that this feat is only one of many that can be performed with model dirigibles. Mr. P. Haselock recently described in *Flight* a method whereby a model dirigible might be controlled by wireless. His experiment follows:

Fig. 1, which shows the *nacelle* of the dirigible in plan form, gives only a general idea of the arrangement of the motors. The front boom is pivoted at the point, P, so that in order to turn to the right (the position shown being the "forward" position) the right motor is stopped and the left motor allowed to swing in the direction of the arrow to the full extent of the cord, E^1. The cords, when the boom is in the "forward" position, hang loose. In its new position the tractor is acting at an angle to the forward line of flight. Similarly the right-hand tractor will turn the machine to the left.

The two motors, M^1 and M^2, which are fixed to the underside of the *nacelle* at about one-third of the entire length from either end, revolve in a horizontal plane in order to lower the dirigible.

Now comes the brain of the machine. This consists of a rim of wood, into which is fixed six segments of metal. These metal segments are connected up with the motors and the bomb-dropping trap. A metal spindle, B (Fig. 2), carries an arm of metal, C; also a ratchet wheel with six teeth. This spindle is made to revolve upon its bearings by elastic wound upon a wooden drum, E. This movement is controlled by a pawl which is kept against the ratchet by means of a small spiral spring. An electro-magnet, C (Fig. 3), actuates the pawl, the wires passing to the coherer, D, and accumulator, E. A set of wires runs from another accumulator to all four motors; also to the electro-magnet which controls the bomb trap. As will be seen from the above, the circuit is completed *via* the metal arm and whatever segment is engaged by same. The "forward" terminal is a joint one, and connects the two motors fixed to the boom.

The working of the apparatus is as follows: When the tapping key of the sending station is depressed, the waves collected by the antennæ magnetise the filings in the coherer, and so allow the current from the accumulator to pass through and attract the pawl. This allows the ratchet wheel to revolve slightly. The pawl when attracted by the magnet taps the coherer, and so disarranges the filings.

(To be Continued.)

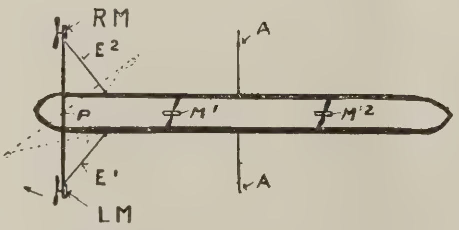
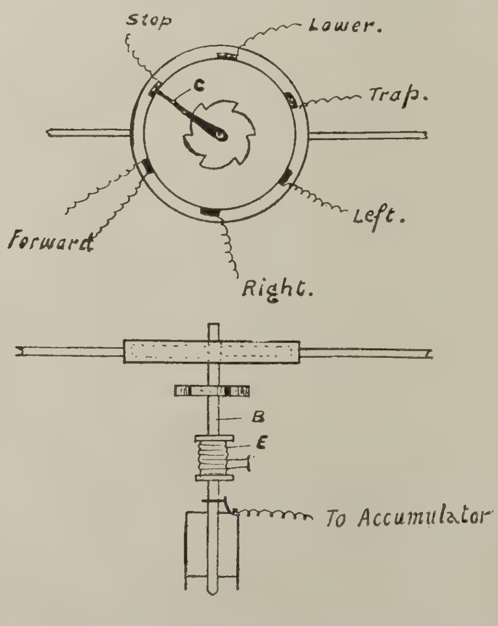


Fig. 1. — A. Antennae. E¹ and E². Cords to control movement of boom. P. Point upon which boom swings. R.M. Right motor. L.M. Left motor. Dotted lines show position of boom when turning to right



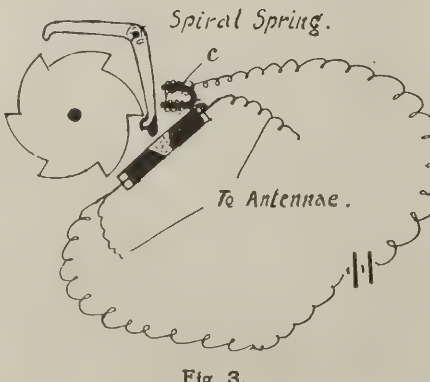


Fig. 3.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Japan Prison Camp.

Editor of that Aerial Age:

Dear Mr:

Though it are many months since I last respond with you through Hon. Post Office, I have several excuse for not so doing. First excuse are these; am in prison once more again. Rest of reasons do not matter.

"But why in jail again, Togo?" (This from you)

"From unfortunate attempt to fly Japan Blimp," I snagger sorrowfully.

"How this happen?" You question me.

"Having read in Hon. Aerial Age of gigantic successes of Blimp in those dear U. S. A. Hon. Japan minister of aviationing request that mechanics of Tokyo get together and built Blimp, eliminating graft as far as possible.

"But one man in these fair lands of rising sun understand to know Blimp building," snagger important man in department of war office.

"And he is whom?" (Minister say this)

"Who should he been but famous Hash. Tago? say man who make first statement.

"Verry well" snagger minister in reciprocity; "give him numerous workmen of great intelligence and start proceeding in constructioning at once."

"But Hon. Sir," respond man, "It are verry impossible to find *workmen* of intelligence. Those of intelligence never work."

"Verry Well" Find much intelligence as possible."

So I am gifted with great responsibility of constructioning immense Blimp for Japanese Army.

"Can you consider yourself capable of doing these great jobs?" I am asked.

"Such trivial things are simplicity thereselves" I correspond with Samirai snagger.

Preceeding to Hon American section of great city of Tokyo I ask Questions and find Hon Gentalmen who say he is greatest Blimp builder, which ever came across pike. While not understanding language, I make strong commission agreement with him, which are like following. He am do all work, I receive most money for seeming intelligence. (These little tricks I learn in American Newspaper office.

Hon. American engage to wire all competant workmen, buy all materials, (Second hand because profits thusly is greater) In justification of early training I note that I do not know second hand materials are to be purchased, therefore do not consider self responsible for great disaster which follow.

To make long storg short in two months extension of time work are completed in great jubilation by workmen and important men in Hon Japanese Empire. Plans are make to fly mashine and dedication exercises. Plans for same appear like these:

BLIMP WILL FLY
Hon. H. Togo Great Aviator.
Flies this A. M.
Your attention is requested.

With feeling of pride I take Japanese Hack to aviationing ground attired in aviation clothes and smiles of pleasure. Immense crowd to number of many thousands gather at grounds to see exercises. I walk on field to great shouts. I step into Blimp with many accomplices which are to fly in company. Undertaker's wagons draw up at edge of field. Hospital corpse practise first aid to dead and dying, while church officials play hyms and sing sorry song.

At no from Mikado, who are in attendence I start machine which trembles from head to toe, and rise from ground very fastly.

"Success" shouts American who build machine he hastilly disappear in crowd with total salary and commission for work.

Just then unfortunate axident happen; machine fly over Imperial grandstand, then with great sigh proceeds to fall apart, and spread all over important ministers, princes and ambassadors. Result are this: injured and dying are many am again in jail for many different crimes. All penalties imposed will keep in jail 853 years. Am very unforunate to be crimnal.

Hoping you are the same

Hashmura Togo.

If Only—

If only the air were not airy,
Nor silly, nor sloppy, nor soft,
Or flying so terribly scary,
How nice it would be up aloft!

If nose dives had not been invented,
And no one had thought of the crash,
Our heads would not be so dented,
And flying would not be so rash.

If 'buses did not need controlling
To put all the little faults right,
Such as diving, or pitching, or rolling,
Why, there would be yells of delight.

If only they'd asked *me* about it,
And just let me fly for a year,
I'd show them that they couldn't doubt it,
But hang it, I shouldn't be here.

E. W. Scott.

TECHNICAL TERMS ILLUSTRATED.

A Nose Dive.—(With apologies to "Veritas.")

N. W. AKIMOFF, M. E.

Exclusive manufacturer and distributor of his improved (model 1917)

Dynamic Balancing Apparatus

wishes to announce that his

LABORATORY OF DYNAMIC BALANCE

centrally located in Philadelphia is prepared to do a limited amount of *outside work* in all lines pertaining to Dynamo Balance of Crankshafts, etc. In writing please state exact nature of product.

OFFICE:
HARRISON BUILDING, PHILADELPHIA

AVIATOR NU-BACK SUITS
WINDPROOF WEATHERPROOF

The NU-BACK aviator's suit is the result of extensive experiments to supply aviators with a light, pliable, warm, wind and weather proof suit at a popular price. Made of "Leathertex," a heavy mole skin, water and oil proof, with felt backing, NU-BACK suits will stand the ravages of oil and grease better than genuine leather.

LIGHT WARM PLIABLE

The suit is lined throughout, coat, pants and hood with NU-BACK lamb, a material manufactured from pure wool, which is a substitute for sheep skin, being just as warm but a great deal lighter and much more pliable. The hood is attached to the coat, making one piece.

For Comfort and Economy you
cannot equal the Nu-Back suit.

Nu-Back Manufacturing Co.
Columbus, Ohio
South High St. and Hocking Valley R. R.

(*Continued from page* 927)

The photographs of the dirigible section showed how correct were the designers of the early vessels of the "M," series, a series which seems almost unmodified during the last two intense years, if one excepts slight improvements to the gun-turret on the forward deck (or back?) and some re-arrangement of the control surfaces, probably to meet the increased motor kick and general improved efficiency in lift.

The firm which has to do with the "Forlanini" show much of technical interest, such as valves, keel-construction, etc., as well as photos of the various vessels of the series, about which silence were golden.

Engineer Canovetti's incessant mental activity is responsible for an ejector, which, however, for want of time and a teacher, I must sidetrack till I can get a first-hand explanation of it.

Only one freak aeroplane was there to puzzle us. Not to be mixed up with helicopter or orthopter, the "Somalvico" circular aerofoil, from which a fuselage with its power plant is suspended by a universal joint, revolves in the reverse direction to the normally placed propeller. In its normal position the section of the circular plane (or planes) is roughly that of a shallow hand-basin *in use,* and so resembles an inverted umbrella. Stability and parachute properties are claimed, and the model has given unexpected results. [A delightfully non-committal, if ambiguous, phrase. —Ed.]

All over the show, mounted and not so, one sees the Marelli magnetos. A four-spark per rev., with separate commutator for even numbered multi-cylindered engines, is an extraordinary and compact little instrument.

The new Redini carburetor is merely a butterfly throttle, in a tube with, loosely attached, a much tapered needle lying in the petrol pipe which enters the induction tube just below the throttle.

As the butterfly valve is opened or shut, it pulls the needle up or down the petrol pipe, which is thus gradually freed or obstructed, so that more or less petrol passes. Thus a variable jet effect is obtained simply and most cheaply. The Redini device is shown fitted to inlet pipes of various motors.

Garlaschelli, of Milan, has a stand of big petrol and oil tanks. Those for the big Caproni, gorgeous in coppered aluminum to attract the eye and the fingers that tap.

Electrically-heated clothing is the effort which the F.A.R.E. Co., of via Pietro Maroncello, Milan, is making to equip one for the altitudes to which "archies" are driving pilots with the assistance, be it said, of the bigger motors everywhere foreshadowed. Gloves, with press-button fasteners as contact-makers, inner soles, head-covering, oil-pipe-heaters, and manifold other applications of their idea, are exposed to make the perspiring visitor envious.

Cabinet making, that old Italian industry, has found its feet again, and is well represented by Zari Bros., who, for instance, stage boat bodies, floats and fuselages for well-known types, all admirable.

Excellent, too, is the woodwork of Attilio Mazzi.

Metallurgy and its professions are too numerous to be even sorted out. That the Italian industries, unschackled from foreign subsidized competition, should have been able to rise so satisfactorily to the occasion is no surprise. The pity is that it could not have been done earlier. No other nation has suffered so from undue modesty, charming, but not business.

American Air-Craft Soon to be Ready for War

Washington.—An Associated Press dispatch states that tests of the first of the standardized United States aeroplane motors designed and built under direction of the Aircraft Production Board make it practically certain that American-made fighting machines will be available for service in France early next year. Results from several tests have been highly satisfactory, it is learned, although details of the design and performance of the engines are withheld.

Probably three distinct types of service craft for the army will be turned out. They will be the small, swift machines designed for air duels and to screen observation and bombing craft; daylight bombing machines, slower than the fighting craft, but still fast enough to minimize the danger from anti-aircraft guns, and big enough to carry observers, photographic outfits, radio, and bombs, in addition to their guns, and the still slower night bombing machines, in which carrying capacity is increased at the expense of speed, because darkness protects them from gunfire.

The United States motor, it is understood, was not designed primarily for speed. Durability and reliability, co-ordinated with a high ratio of power for each pound of engine weight, was the object of the American engineers who worked out the plans.

The first motor produced was employed exclusively as a model from which gauges and fixtures could be made, so that numerous factories could be equipped to turn out in great quantities various parts of the engine. The progress of this element of the work indicates an early supply of the motors for service at the front.

Meanwhile the engineers are making every effort to improve the design and incorporate new features. As rapidly as improvements are developed, they will be incorporated in subsequent motors, the same efforts toward quantity production being made each time the design is altered.

There are indications also that American engineers and military men are not satisfied to accept without question the verdict of the French and British air services as to the most satisfactory types of craft for fighting purposes. Many officials here believe that while the fighting machines that are winning fame for individual aviators are spectacular, and therefore have a strong hold on the aviation personnel, they are not the most efficient fighting craft. They carry one man, and one machine gun. They are all engine, and every other consideration has been disregarded for speed. The machines make as much as 130 miles an hour, while the observation machines which spot artillery fire are rated at little more than 100 miles, and the big bombing machines are even slower.

It is pointed out that naval development has tended toward big ships. The superdreadnought is still the master of the surface of the sea, despite the submarine. No oversurface vessel, whatever its speed or size of its guns, can stand before the combined armor and armament of the battleship.

Presumably the same thing would be true in the air. If a machine could be built that could carry many guns and light armor, it could disregard the fighting craft of the present, beating them off with its greater gunfire, and proceeding on its way without regard to the wasps of the air.

Efforts have been made in Europe to produce battleplanes on this scale. So far, apparently, they have not been successful for various mechanical reasons. This has not discouraged American designers, however, who hope that a way will be found to combine in one ship such offensive and defensive power, together with all the equipment of observation and bombing machines that would displace the swift fighters of to-day and put them in the category of scouts.

Announcement

In view of the urgent requirements of the United States Government for

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(*Continued from page* 923)

The problem offered by the "spotters" is, however, a different one. They will climb sufficiently high and sufficiently far away from the guns, if possible, to be safe. If they are amply protected by destroyers and scouts, the question of their destruction does not seem to be a serious one. They must be accepted, under the conditions assumed, as a disagreeable factor to be reckoned with, and efforts will be made to keep them as far away as practicable. If they can be kept at 10,000 but, then spotting will be exceedingly difficult for them; and, due to the film of smoke which will arise from the shore guns and any haze that may be over the ground, it may safely be assumed that if their spotting is to be of any value, they must be at least within 6000 feet of the striking points of the shells.

In order to determine upon the type of guns to be used in anti-aircraft defense, we have now to consider what will constitute effective hits on the aircraft of the various types discussed.

Shrapnel, or small arms fire, will only give effective hits when they strike the personnel, gasoline tanks, delicate parts of the motor, the propeller, and controlling parts of the mechanism. The Studevant people have constructed an all-steel battle aeroplane in which the motor, the controlling parts of the mechanism, the gasoline tanks, and the personnel are pretty well protected against such hits. Abroad they use calibers approximating 75 mm., and they use both shrapnel and high explosive shell with time fuses. These shell or shrapnel must make direct hits on the parts mentioned to wreck the machine.

The detonation of a medium-caliber, high-explosive shell within 100 feet of an aeroplane might cause the plane to dive or capsize, but would not necessarily wreck the machine. Aeroplanes have landed safely within their own limits with as many as 400 holes through the wings and fuselage.

The ordinary machine guns, such as the Benet, Lewis, etc., the latter of which is largely used abroad, do not use ammunition varying much from the ordinary .30 caliber used in the Springfield small arms. The data available for the Springfield will therefore give us a standard of comparison. The maximum vertical range for small arms has been determined to be approximately 10,000 feet, and at 4,000 feet the striking velocity is only some 900 feet per second. We may therefore rest assured that aircraft are fairly safe from machine gun or rifle fire at 4,000 feet. They are effective at 6,000, so we must have something more harmful to use in firing at them.

The Ordnance Department has determined that a 3-inch, 15-pounder, having the same general construction and ballistics of the 15-pounder, model of 1903, with a 7-caliber ogive, will give a maximum altitude of 30,000 feet when using a muzzle velocity of 2,600 feet per second. The higher the altitude, the greater the muzzle elevation and the more uncertain are the elements which enter into the ballistic computations.

It is a well-known fact that the velocity of the air varies at the same place in different strata; and while in big gun practice, we assume a constant velocity and direction of the wind, it is only because the shell from a gun travels in the same stratum. As soon as motors are involved the variations due to different strata through which the projectile passes introduce some curious results. It is impossible to deduce a rule, because the variations of strata in one day are different from those on another. Some very interesting models are shown on page 235 of the *Journal U. S. Artillery* for September-October, 1916, illustrating the different velocities of air at different levels at the same vicinity. However, these problems must be met, and are being met by the ballistician and mathematician, and several rules of thumb have been deduced for approximating the height of an airship. We assume, moreover, that the Ordnance Department has a reasonable range finder, and accurate setting device, when they announce that the "safe" elevation is at least 12,000 feet.

There is an advantage, also, to the defenses in the fact that their aeroplanes are not burdened with drop bombs, can climb faster and outmaneuver the raiders who may be forced to drop their bombs prematurely in order to get away safely. Thus, if the defenses still have a few aircraft left, they may be used very advantageously.

If the raiders succeed in getting well within the effective limit of bomb throwing, then they must be attacked with machine guns. They are liable to do so, and it is evident that the defenses must have machine guns capable of being fired at any angle and from any position.

We must keep the scouts and destroyers at least 6,500 feet away, if possible, and if they still continue to sweep down, to attack them with machine guns.

What means of attack by guns offers the best chance of success?

Evidently by directing a group of shots ahead of the target, calculating to create a dangerous zone through which the aircraft must fly.

The guns, should, if practicable have an uninterrupted view of the horizon in all directions. The range finder and director being in the center of the battery makes this nearly mandatory.

It should also be remembered that there will be no time for relocating against aircraft traveling 60 miles or more an hour.

A consideration of the above induces us to believe that the following should be controlling principles in locating the anti-aircraft emplacements containing the 3-inch (15-pounders) and the machine guns.

a. The most effective fire and fire control will be obtained by locating the guns in groups of four, each gun at the corner of a 200-foot square with the director at the center.

b. To attack effectively, the hostile aeroplanes must be at an altitude of 6,000 feet or less and approximately over the object being attacked.

c. The emplacements should be so located as to prevent hostile aeroplanes from reaching the position indicated in par. (b), *supra,* and should be able to bring a converging fire on any aeroplanes that are successful in attaining that position.

d. A single gun or group of guns defending any point, should be, when practicable, at least 1,000 yards from that point.

e. The emplacements should be mutually supporting.

f. If practicable, the guns should have an uninterrupted view of the horizon in all directions.

g. Other considerations being equal, the emplacements should be located on government reservations.

h. Machine guns in groups of four or six should be located very close to the positions to be defended.

These anti-aircraft batteries should be controlled by an officer (director) stationed at the center of the battery, assisted by the necessary enlisted personnel, and the batteries should be organized into higher units, composed of those batteries which are mutually supporting. As these batteries are designed to protect certain elements of the defenses, the commander of the elements which they protect should also be the commander of the unit into which the groups are organized. The same general supervision exercised over the other elements of the defense by the coast defense commander, should be exercised by him over the anti-aircraft defenses.

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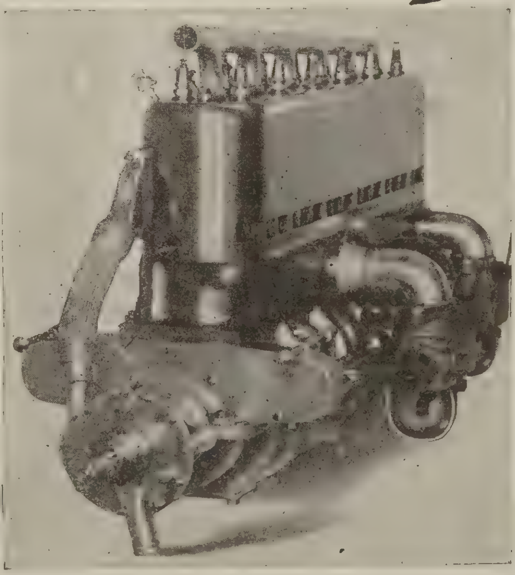

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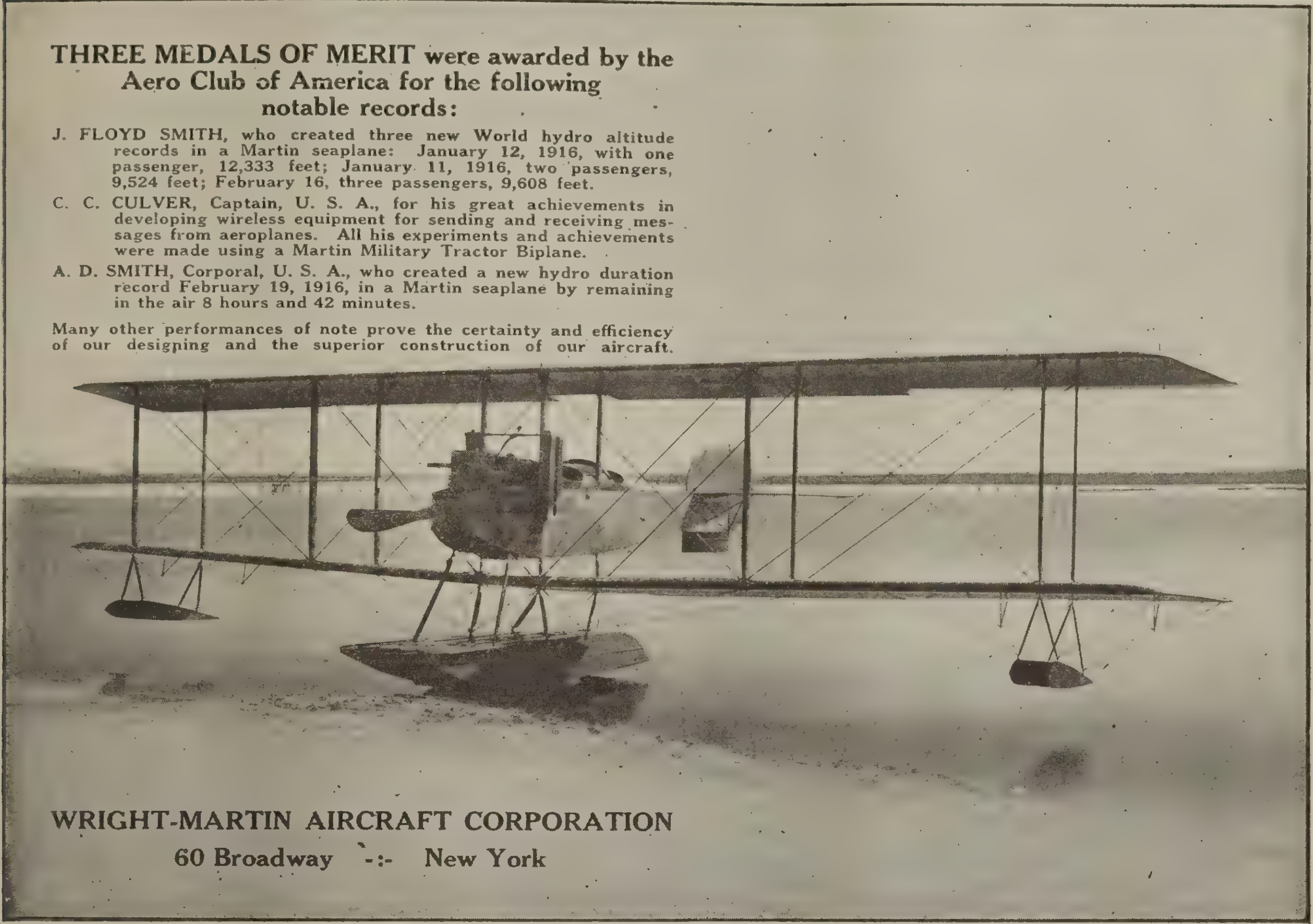

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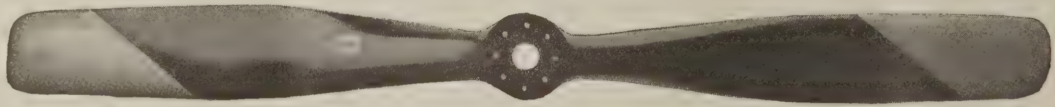

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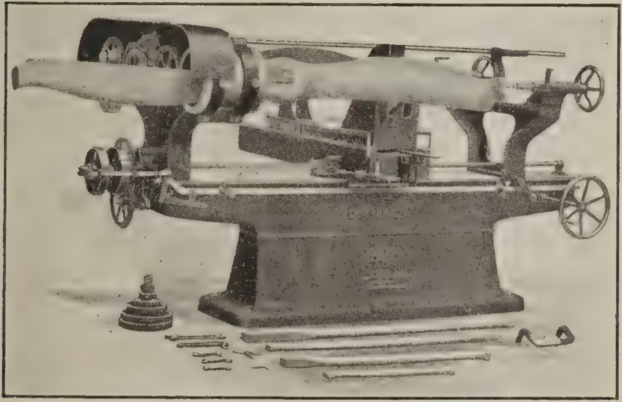
The feeding mechanism which controls the cutter-head carriage, is arranged to feed from right to left or from left to right alternately, or, it may be adjusted to feed in one direction only. The starting station may be at the right or left hand end of the machine as desired. It has five changes of feed from ⅛" to ⅜" varying 1/16" to each revolution of the work being turned and it can be started or stopped instantly at any position instantly at any position of the cut. At the slowest rate of feed it will turn 2½" per minute and at the fastest rate 13" per minute. Adjustable stops are provided for automatically regulating the length of travel to the cutter-head, which can be instantly set for any length of turning within the range of the machine.

The cutter-head is fitted with six right and six left hand knives to feed both ways and will turn successfully either hard or soft wood. It is mounted upon a sliding frame and supported by a substantial carriage which travels across the path of the material to be turned by means of a heavy feed screw driven by double friction pulleys operated by a convenient hand lever for starting the feed which is automatically disengaged when the end of the cut is reached. The frame supporting the cutter-head and guide roller is gibbed to the carriage and vibrates in a path to correspond with the shape of the model placed into the machine and is connected with a convenient hand lever to bring the cutter-head up to the work or throw it back out of the way, which can be accomplished while the machine is in motion.

A hollow chuck is used when turning propellers on this machine, as each blade of the propeller is turned separately. The propeller is clamped in this chuck by means of a pin which is inserted through the hub, holding it securely and centering it accurately. This chuck is also used when turning struts that measure over five feet in length.



A copying lathe for turning propellers and struts

An ingenious centering device can be furnished when so ordered for centering the stock before being placed into the machine. By this method smaller stock in the rough can be used which effects a larger saving in material. This device locates the center marks quickly and accurately.

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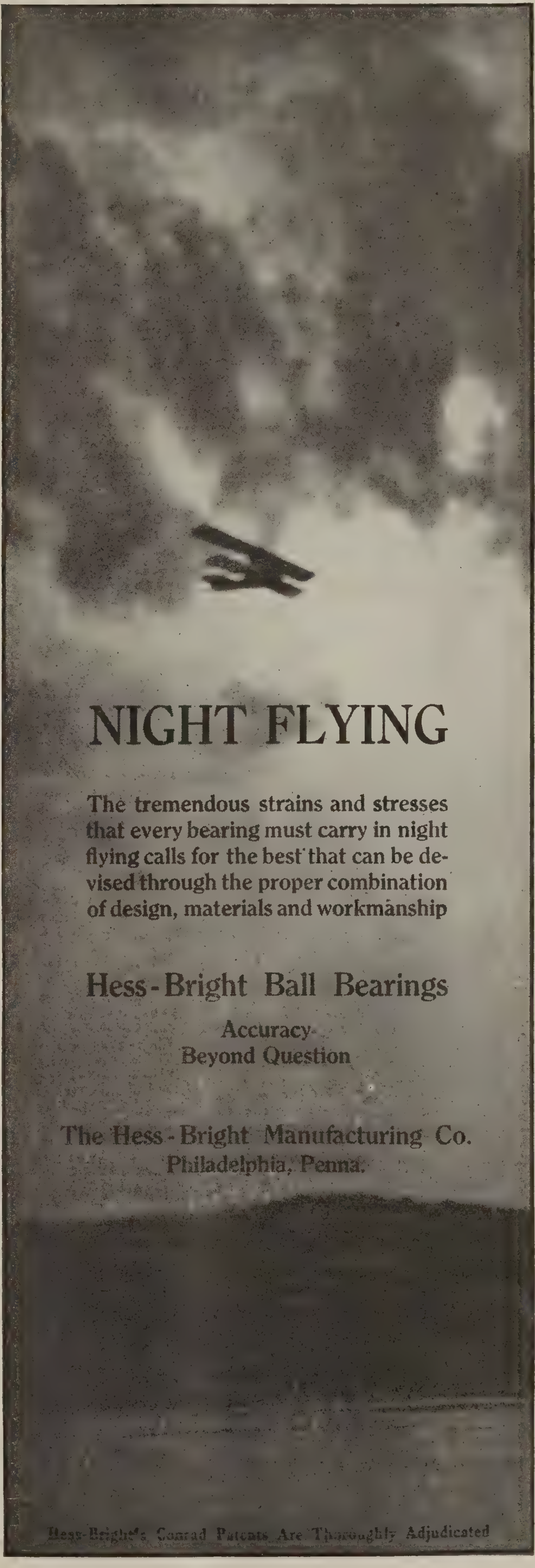

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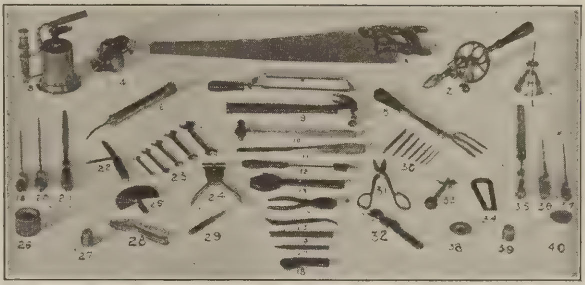

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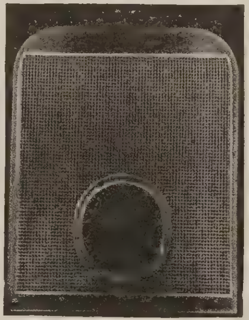

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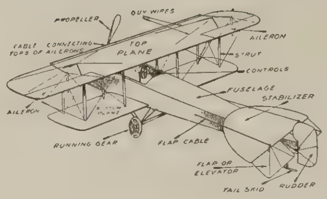

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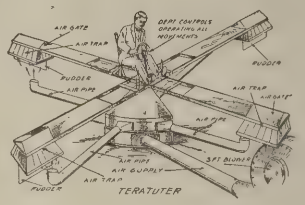

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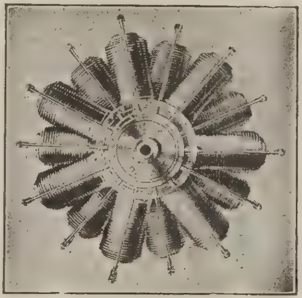

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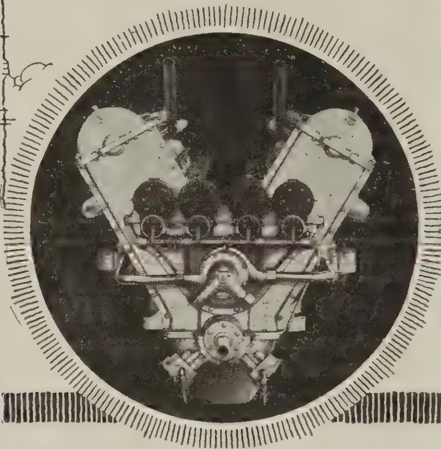

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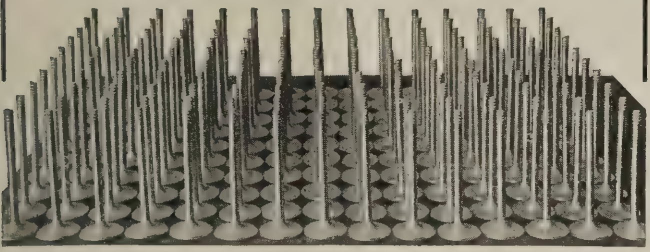

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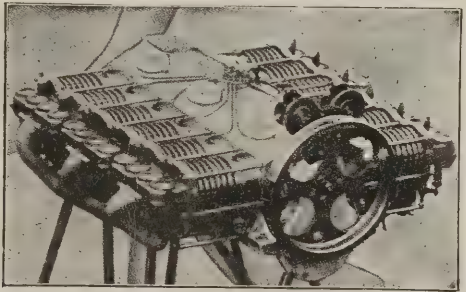

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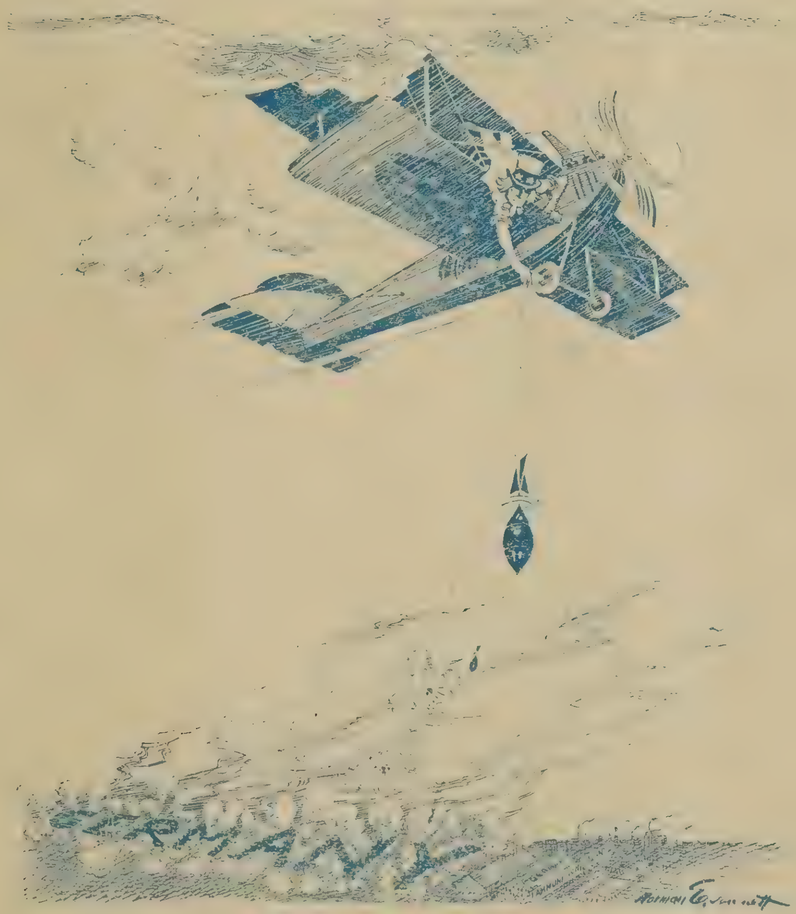

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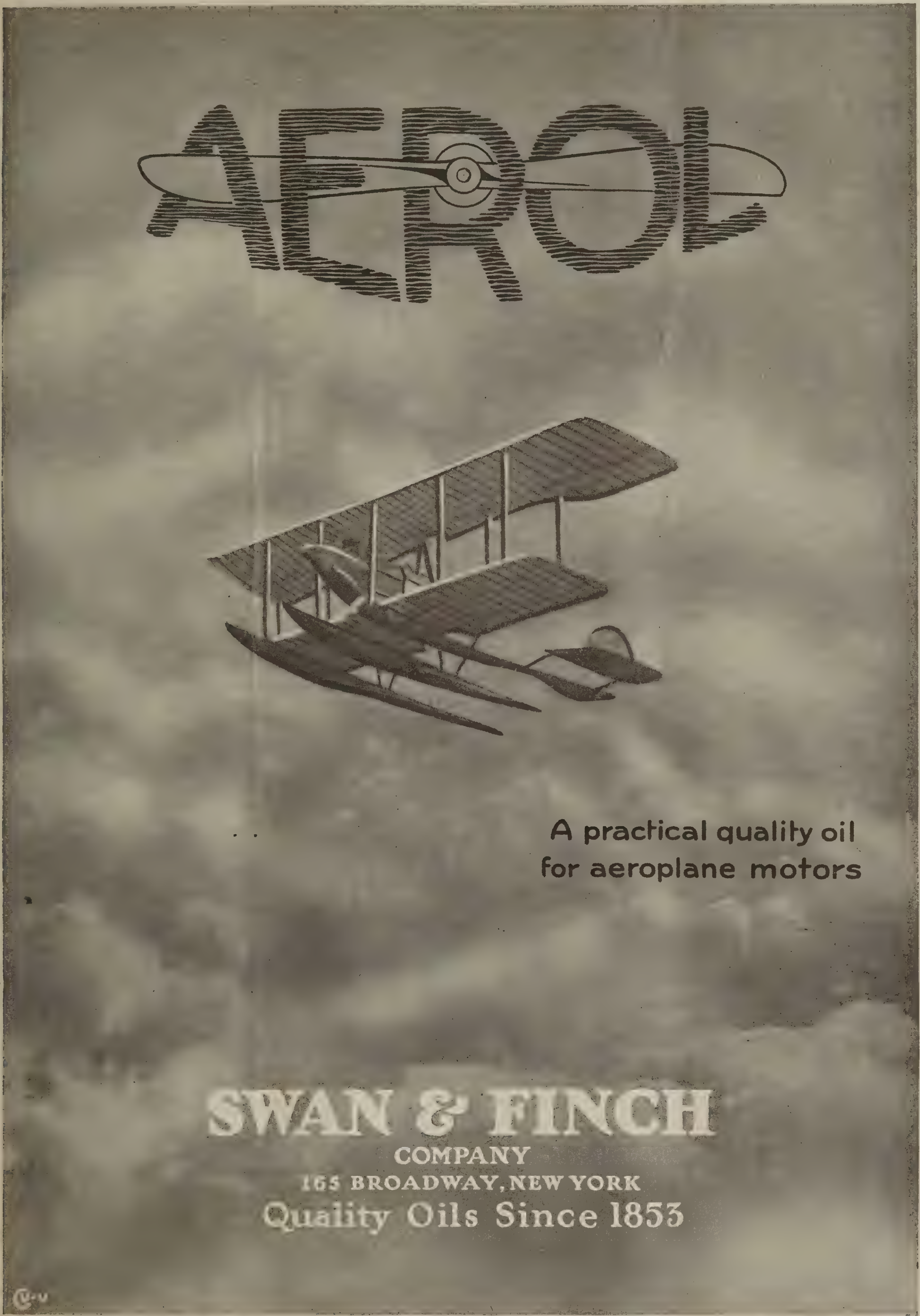

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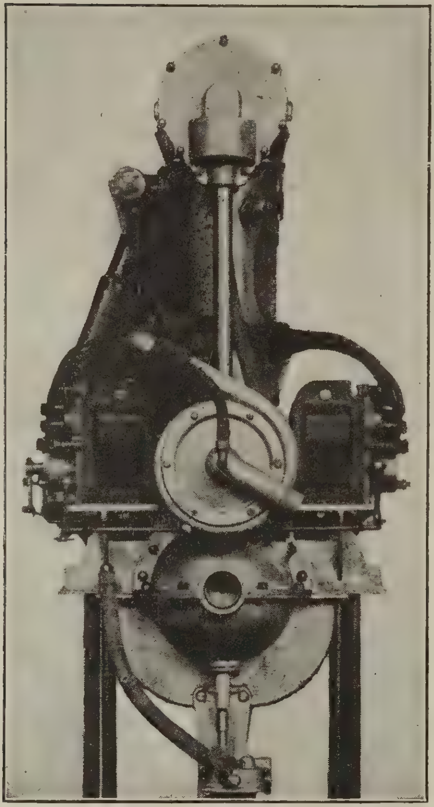

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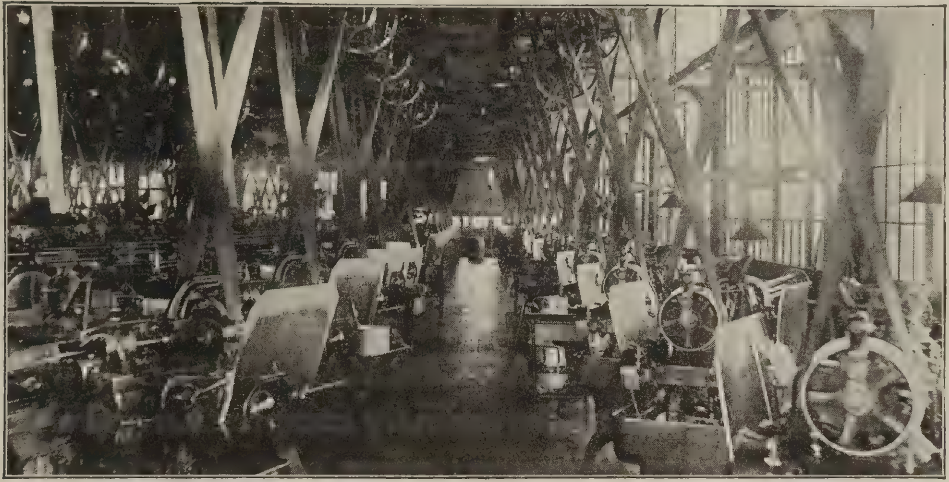

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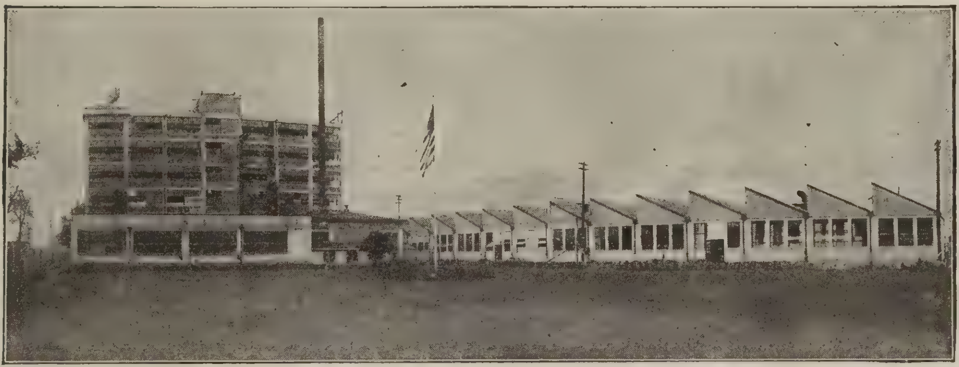

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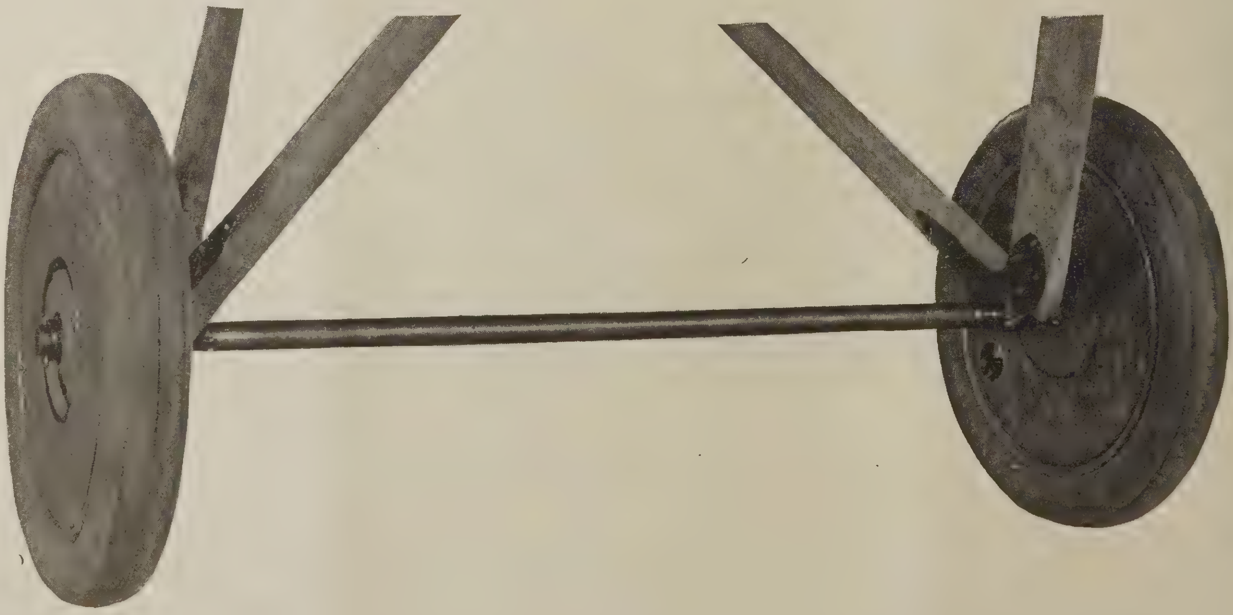

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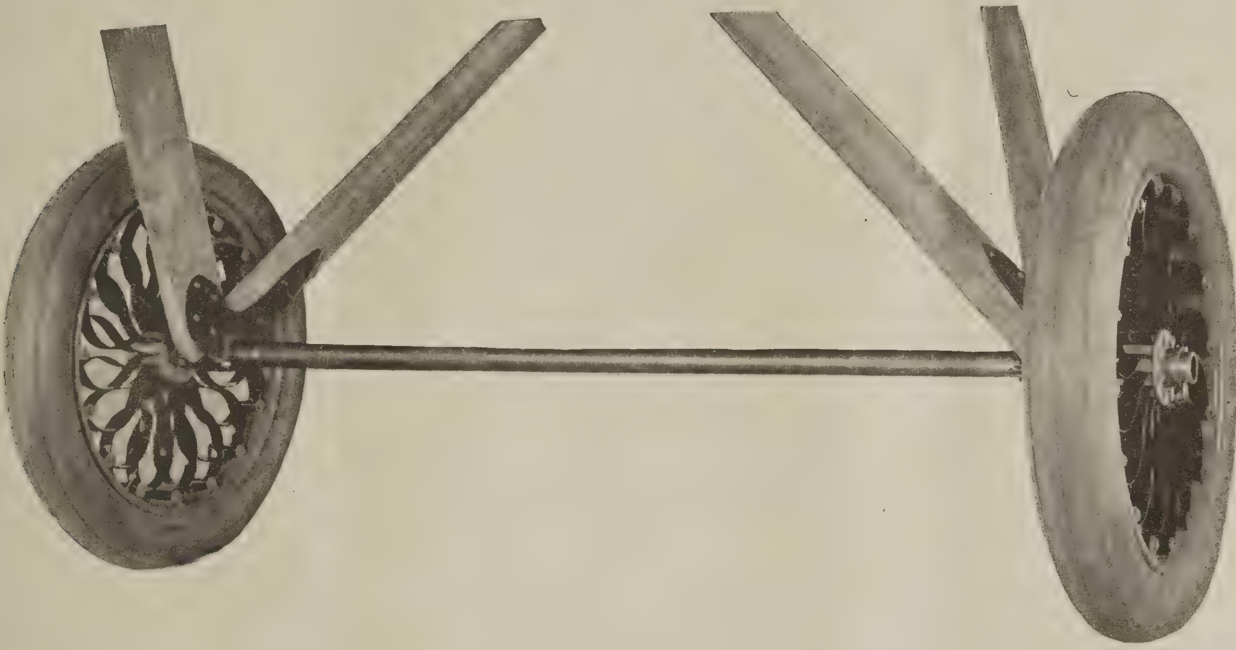

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TO FIGHT UNTIL AUTOCRACY IS ENDED

President Wilson's Note to Pope Benedict XV Confirms America's National Policy

PRESIDENT WILSON'S note to Pope Benedict XV confirms America's national policy to fight until autocracy is ended.

By his firm, courteous, definite declination of the Pope's invitation to America to enter with our allies into negotiations with the German Government on the basis of the situation before the war, President Wilson, interpreting the mind of the American people, has rendered a service to this country, to the Allies, and to the world for which freemen are no less thankful because it was done in the line of his duty. By this reply to the Pope, President Wilson has added new bonds to our union with our allies, has served to divide our enemies, has weakened the force of pacifism and disloyalty at home, and has reinforced the power of democracy in Russia and even in Germany.

It was fitting that the President at the outset of his communication should express the natural desire of America for the normal life of peace; but it is true understanding of the temper and spirit of America that has led him to subordinate that desire to the determination to reach the goal of a peace that is "stable and enduring."

Because this letter is concise and is likely to serve as in substance the reply of our allies as well as our own reply, we reprint it herewith:

To His Holiness Benedictus XV, Pope:

IN acknowledgment of the communication of your Holiness to the belligerent peoples, dated August 1, 1917, the President of the United States requests me to transmit the folowing reply:

Every heart that has not been blinded and hardened by this terrible war must be touched by this moving appeal of his Holiness the Pope, must feel the dignity and force of the humane and generous motives which prompted it, and must fervently wish that we might take the path of peace he so persuasively points out. But it would be folly to take it if it does not in fact lead to the goal he proposes. Our response must be based upon the stern facts, and upon nothing else. It is not a mere cessation of arms he desires; it is a stable and enduring peace. This agony must not be gone through with again, and it must be a matter of very sober judgment what will insure us against it.

His Holiness in substance proposes that we return to the *status quo ante-bellum* and that then there be a general condonation, disarmament, and a concert of nations based upon an aceptance of the principle of arbitration; that by a similar concert freedom of the seas be established; and that the territorial claims of France and Italy, the perplexing problems of the Balkan States, and the restitution of Poland be left to such conciliatory adjustments as may be possible in the new temper of such a peace, due regard being paid to the aspirations of the peoples whose political fortunes and affiliations will be involved.

It is manifest that no part of this programme can be successfully carried out unless the restitution of the *status quo ante* furnishes a firm and satisfactory basis for it. The object of this war is to deliver the free peoples of the world from the menace and the actual power of a vast military establishment controlled by an irresponsible government, which, having secretly planned to dominate the world, proceeded to carry the plan out without regard either to the sacred obligations of treaty or the long-established practices and long-cherished principles of international action and honor; which chose its own time for the war; delivered its blow fiercely and suddenly; stopped at no barrier, either of law or of mercy. swept a whole continent within the tide of blood—not the blood of soldiers only, but the blood of innocent women and children also, and of the helpless poor; and now stands balked, but not defeated, the enemy of four-fifths of the world.

This power is not the German people. It is the ruthless master of the German people. It is no business of ours how that great people came under its control or submitted with temporary zest of the domination of its purpose; but it is our business to see to it that the history of the rest of the world is no longer left to its handling.

To deal with such a power by way of peace upon the plan proposed by his Holiness the Pope would, so far as we can see, involve a recuperation of its strength and a renewal of its policy; would make it necessary to create a permanent hostile combination of nations against the German people, who are its instruments; and would result in abandoning the new-born Russia to the intrigue, the manifold subtle interference, and the certain counter-revolution which would be attempted by all the malign influences to which the German Government has of late accustomed the world.

Can peace be based upon a restitution of its power or upon any word of honor it could pledge in a treaty of settlement and accommodation?

Responsible statesmen must now everywhere see, if they never saw before, that no peace can rest securely upon political or economic restrictions meant to benefit some nations and cripple or embarrass others, upon vindicative action of any sort, or any kind of revenge or deliberate injury. The American people have suffered intolerable wrongs at the hands of the Imperial German Government, but they desire no reprisal upon the German people, who have themselves suffered all things in this war, which they did not choose. They believe that peace should rest upon the rights of peoples, not the rights of governments—the rights of peoples, great or small, weak or powerful—their equal right to freedom and security and self-government, and to a participation upon fair terms in the economic opportunities of the world, the German people, of course, included, if they will accept equality and not seek domination.

The test, therefore, of every plan of peace is this: Is it based upon the faith of all the peoples involved, or merely upon the word of an ambitous and intriguing Government, on the one hand, and of a group of free peoples, on the other? This is a test which goes to the root of the matter; and it is the test which must be applied.

The purposes of the United States in this war are known to the whole world—to every people to whom the truth has been permitted to come. They do not need to be stated again. We seek no material advantage of any kind. We believe that the intolerable wrongs done in this war by the furious and brutal power of the Imperial German Government ought to be repaired, but not at the expense of the sovereignty of any people—rather a vindication of the sovereignty both of those that are weak and of those that are strong. Punitive damages, the dismemberment of empires, the establishment of selfish and exclusive economic leagues, we deem inexpedient, and in the end worse than futile, no proper basis for a peace of any kind, least of all for an enduring peace. That must be based upon justice and fairness and the common rights of mankind.

We cannot take the word of the present rulers of Germany as a guarantee of anything that is to endure unless explicitly supported by such conclusive evidence of the will and purpose of the German people themselves as the other peoples of the world would be justified in accepting. Without such guarantees treaties of settlement, agreements for disarmament, covenants to set up arbitration in the place of force, territorial adjustments, reconstitutions of small nations, if made with the German Government, no man, no nation, could now depend on.

We must await some new evidence of the purposes of the great peoples of the Central Powers. God grant it may be given soon and in a way to restore the confidence of all peoples everywhere in the faith of nations and the possibility of a covenanted peace.

Robert Lansing,
Secretary of State of the United States of America.

ITALY READY TO DEMONSTRATE THAT AEROPLANES CAN BE FLOWN ACROSS THE ATLANTIC

"WILL the United States Government or a group of enterprising Americans be willing to spend five million dollars to show, by flying the latest Italian air cruiser across the Atlantic, that the U-boat menace can be ended for good?" This was the startling query which Major R. Perfetti, of the Royal Italian Flying Corps, head of the Special Italian Aeronautic Mission in the United States, put to the large gathering of prominent people at Newport, Rhode Island, Friday evening, August 31st, under the auspices of the National Special Aid Society.

He continued: "People have been calling me up to express their wonderment at the fact that the huge Italian Caproni triplanes have been conducting continuous operations against the Austrian bases, enabling the Italians to win victories which could not have otherwise been won. It is true that we have developed in Italy some extraordinary aeroplanes and motors, and that the only thing that prevents our developing huge air fleets with which to strike at our common enemy is the lack of raw materials—materials which the United States and Great Britain may now, we hope, supply us.

"The distinction of conducting the largest air raid ever conducted so far went to Italy a few days ago when 232 aeroplanes, most of which were, unfortunately, of the smaller type, stormed an Austrian base. The raid was successful and only one aeroplane failed to return.

"This raid showed more than ever the revolutionary value of aircraft and why the world's authorities now believe that the war is to be decided in the air.

"Up to recently the one difficult problem of the Allies was to find a means of eliminating the U-boat menace. The U-boat has been destroying ships faster than the Allies have been able to build them and whenever there have been considered plans for building the tens of thousands of aeroplanes needed with which to strike Germany through the air, it has always been found that the aerial program was being limited by that one difficult problem of shipping the aeroplanes to Europe after building them here in America, because it would take practically most of the tonnage available to carry the tens of thousands of aeroplanes needed and which the United States can build but cannot deliver.

"I glad to be able to say now that there is a solution to this problem at hand and that the United States Government or any group of patriotic Americans can test the plan which I propose for a few hundred thousand dollars—although I personally hope that not less than five million dollars will be set aside to undertake to carry out this plan, which consists of taking the latest Italian air cruisers which can carry twenty-five passengers and building another even larger air cruiser, the designs of which have just been completed by the same Italian engineers who designed and built the 25-passenger machine and flying these machines arcoss the Atlantic.

"This would solve for good the problem of sending aeroplanes from the United States to the Allies—and whereas it is less than 500 miles from Great Britain to Kiel, Wilhelmshaven, Heligoland, Essen and other German U-boat and military bases, these air cruisers delivered from the United States to Europe by air line can then be sent to destroy the German bases.

"These two giant air cruisers are the latest Italian developments in aeronautics. Having to fight a powerful enemy over the Gorizia mountains and across the Adriatic Sea, the Italians have had to evolve dreadnaughts of the air, which can fly over mountains and across seas. The result was that Italian genius developed the large Caproni triplanes, the fast Pomilio, Maccohi, S. I. A., Savoya-Verduzio, and other most efficient aeroplanes, which now hold all the world records, including the record for useful weight carried, which is close to five tons; the greatest speed, our latest Pomilio making 157 miles per hour, the largest distance covered in a single flight, which happened three days ago when an Italian officer flew 920 miles from Turin to Naples, without stop, which took only about ten hours. Our flying boats like our land machines, hold records; and our Isotta Fraschini, S. P. A. and others, which range up to 600 horse-power, per motor, and will soon be 1,000 horse-power, are acknowledged to be the best in the world.

"Two months ago I announced at a meeting held at the Automobile Club of America, under the auspices of the Aero Club of America, that I expected soon to be able to announce as a fact that we would have aeroplanes capable of carrying from twenty-five to fifty passengers each. I am now glad to state it as a fact that these machines can be built, and that Italy will be glad to supply a number of these air cruisers to the United States Government or to any group of patriotic Americans who may wish to demonstrate the possibility of delivering aeroplanes to Europe by flying them there.

"We will be glad to undertake not only to supply the machines, but to fly them across the Atlantic for the United States Government or patriotic people who may undertake to do this.

"Will the United States Government or a group of enterprising Americans be willing to spend five million dollars to show, by flying these latest Italian air cruisers arcoss the Atlantic, that the U-boat menace can be ended for good?"

The meeting, which was held under the auspices of the National Special Aid Society, was presided over by Mr. Alan R. Hawley, president of the Aero Club of America, who came from New York to attend the meeting with Congressman Murray Hulbert of New York, Rear Admiral Bradley A. Fiske, and Henry Woodhouse.

The patrons and patronesses were as follows: Governor and Mrs. R. Livington Beeckman, Governor and Mrs. Charles S. Whitman, Col. and Mrs. Henry D. Todd, Captain and Mrs. Henry F. Ryan, Commander and Mrs. Rufus T. Johnston, Mrs. Hugh Dudley Auchincloss; Mrs. Charles N. Baldwin, Mr. and Mrs. Colville Barclay (counselor British Embassy), Mr. and Mrs. J. Stewart Barney, Mr. and Mrs. Edward J. Berwind, Mr. and Mrs. Woodbury Blair, Mrs. George T. Bliss, Miss Susan Bliss, Mr. and Mrs. William B. Bristown; Mrs. Harold Brown, Mr. and Mrs. I. Townsend Burden, Mrs. Alexander J. Cassatt, Mrs. Charles A. Childs, Mr. and Mrs. James Henry Darlington, Captain and Mrs. Dudley Davis, Miss Martha de Barril, Mr. and Mrs. James B. Duke, Mr. and Mrs. Stuart Duncan, Mr. and Mrs. Arthur B. Emmons, Lieut. Com. and Mrs. Marion Eppley, Mr. and Mrs. Geo. Peabody Justis, Mrs. Rogley Dunglison Evans, Mr. and Mrs. E. Hayward Ferry, Mr. and Mrs. William Cammell, Mr. and Mrs. Frederick P. Garretson, Mr. and Mrs. Elbridge Gerry, Miss Mabel Gerry, Mr. and Mrs. Lawrence Lewis Gillespie, Mr. and Mrs. Austen Gray, Mrs. William Grosvenor, Miss Mary Gwynn, Mr. and Mrs. Herbert M. Harriman, Mr. and Mrs. W. Barklie Henry, Mr. and Mrs. Charles Betts Hillhouse, Mr. and Mrs. Charles Frederick Hoffman, Dr. and Mrs. Henry Berton Jacobs, Mr. and Mrs. Arthur Curtiss James, Mrs. William Jay, Mr. and Mrs. Oliver Gould Jennings, Miss Fanny L. Johnson, Mr. and Mrs. Pembroke Jones, Mr. and Mrs. Lewis Quentin Jones, Mr. and Mrs. Granville Kane, Mr. and Mrs. Prescott Lawrence, Mr. and Mrs. William de Forest Manice, Mr. and Mrs. William Starr Miller, Mr. and Mrs. Ogden Mills, Mr. and Mrs. Charles Moran, Mrs. Frederick Neilson, Mr. and Mrs. Bradford Norman, Lieut. Col. the Hon. and Mrs. Nurrough O'Brien, Mr. and Mrs. Edward H. Padelford, Mrs. Frederick Pearson, General and Mrs. Fred. Pierson, Captain and Mrs. Alexander D. B. Pratt, Dr. and Mrs. Alexander Hamilton Rice, Mrs. Burke Roche, Mrs. George S. Scott, Mrs. Louise Scott, Mrs. W. Watts Sherman, Mrs. Hope Slater, Rev. Dr. and Mrs. Roderick Terry, Mrs. Hamilton McK. Twombly, Mrs. James H. Van Alen, Mr. and Mrs. Michael M. Van Beuren, Mrs. French Vanderbilt, Mrs. Reginald Vanderbilt, Mr. and Mrs. Hubert Vos, Mr. and Mrs. George Henry Warry, Mrs. Whitney Warren, Mr. and Mrs. William Storrs Wells, Mr. and Mrs. William F. Whitehouse, Mr. and Mrs. Harry Payne Whitney, Mr. and Mrs. Joseph E. Widener, Lieut. and Mrs. John Wolfe.

A song especially written for this meeting was sung for the first time by Mrs. May Hartmann, entitled "If the World Should End Tomorrow," and was greatly applauded.

(**Continued on page** 973)

THE NEWS OF THE WEEK

Reception to Italian Aviators

A reception was tendered to the Italian aviators of the Special Italian Aeronautic Mission in this country at the Aero Club of America. The Italian officers in the party included Major R. Perfetti, head of the Special Italian Aeronautic Commission in the United States, Captain Pomilio, also of the Special Commission, and Lieut. Silvio Rasnati, Lieut. Giuseppe Adamoli, Lieut. Felice Teutoni and Lieut. Michele Ballerini, all of the Royal Italian Flying Corps. Messrs. Alan R. Hawley, president of the Aero Club of America, Henry Woodhouse and Charles Jerome Edwards and Henry A. Wiss Wood, members of the Board of Governors, William Hawley and G. Douglas Wardrop were in the party.

Major Perfetti spoke of the latest Italian warplanes, which are equipped with three motors of 700 H.P. each and are capable of crossing the Atlantic and pointed out that this type of aeroplane could be built in large number in this country and flown to Europe.

Major Perfetti stated that the concern which is making the Caproni aeroplanes in Italy with the co-operation of the Italian Government, will be able to arrange to demonstrate the possibility of flying from Genoa to New York with several stops by the way of the Azores. He expressed his hope that a group of patriotic Americans or the Government of the United States may undertake to carry out this plan and stated that the Italian Government will co-operate in every way possible. Lieut. Resnati, who has flown the large Caproni machines for 3,200 hours, stated that he considers the flight across the Atlantic feasible in every way and he is ready to undertake it. The Italian officers were entertained at dinner and to the theatre after dinner.

Glenn L. Martin Resigns from Wright-Martin Company

The resignation of Mr. Glenn L. Martin was accepted by the directors of the Wright-Martin Company on August 27th.

Mr. Martin is now in Cleveland, where he has organized a new company which will produce aircraft in large quantities. The new company will have $2,500,000 capital, all of one class, every share to be sold at par, with no bonus stocks. Cleveland's most successful men are interested in the project, including S. L. Mather, C. W. Bingham, Charles E. Thompson, W. G. Mather, Carl N. Osborne, Caleb S. Bragg.

Charles E. Thompson, who is president of the Steel Products Co., will be president of the new company; Glenn L. Martin, vice-president, and general manager.

Akimoff Has Laboratory

N. W. Akimoff, inventor and manufacturer of dynamic balancing apparatus, has just completed the organization of a special laboratory of dynamic balance, with headquarters in Philadelphia. The laboratory will be devoted to the demonstration of dynamic balance, acceptance tests to educating operators of dynamic balancing machines and to practical balancing work.

$25,000,000 Order for Overland

Toledo.—Willys-Overland Co. has received a $25,000,000 order for aeroplane parts for the United States and Allies. This order includes bolts, nuts, turnbuckles, etc., and is given on a twenty-eight week contract, Under the contract terms, half of the capacity of the Curtiss plants will be devoted to aeroplane requirements of the Allies. The agreement applies regardless of the capacity Curtiss finally attains. The Curtiss company will complete 200 biplanes for Great Britain within two weeks, the order amounting to $6,000,000.

Zimmerschied Completing Steel Specifications for Aeroplanes

Washington, Aug. 27.—Specifications for steel for aeroplane parts, being prepared under the direction of Karl W. Zimmerschied, are about complete. The task has been an arduous one and Mr. Zimmerschied has surrendered his position as vice-chairman of the Co-operative Committee on Automotive Transport that he might give more time to the steel specifications.

Mr. Zimmerschied also in giving much time to the Committee on International Aeroplane Standardization. His successor on the Committee on Automotive Transport has not yet been announced.

Mr. Frank H. Russell, of the Burgess Company, President of the Manufacturers' Aircraft Association

Lelands Form Lincoln Motor Co.

Detroit.—Henry M. Leland and Wilfred C. Leland, who resigned as president and general manager of the Cadillac Motor Car Co., have completed organization of a $1,500,000 aeroplane company. The concern has been incorporated as the Lincoln Motor Co. and has a factory composed of buildings formerly occupied by the Rands Mfg. Co. One hundred men are now at work. Two thousand will be employed soon.

An output of twenty aeroplane engines per day at an early date is assured. Immediate associates in the company are: Lelands; W. H. Murphy; Joseph Boyer, John Trix; George H. Laying; W. R. Johnson; William T. Nash; Frank Johnson; A. U. Widman; Ernest E. Sweet; Le Roi J. Wildams; E. T. Randall; J. Wilbur Brown, and M. W. H. Wilson. The company will manufacture U. S. A. engines.

Allied Aviators Here

Eight Italian army officers, mostly from the aviation corps, arrived August 28 under command of Captain Carlo Tappi. The object of their trip will be to purchase and inspect American aeroplanes and materials for use in the Italian army, it is understood.

With the Italians were three more French aviation officers, who will serve as instructors to American airmen, and five officers of the United States army who have been studying the needs of our forces in England and France.

Conquer Arctic by Aeroplanes, is MacMillan Idea

Sydney, N. S.—Donald B. MacMillan, who reached here upon a relief ship after four years of rigorous life in the Arctic regions, may attempt a return to the Far North soon by an aeroplane instead of the ice-breaking vessels and dog teams of the past.

The intimation that this will be his next venture came in a statement to-day from the explorer in which he grew enthusiastic about the wonders of the polar regions.

"I have work to do there yet," he said. "I have about one hundred and fifty miles of coast to explore and I hope to go back soon. The north is the land of men.

"I know very little of the great advances made in aircraft work," he continued, "but I have learned what the war has brought about in conquering the air, and I am now convinced that the use of the aeroplane in exploring work in the north is bound to come. An explorer with an aeroplane could accomplish more work in one day than he could in twenty with a dog team."

Airmen to Drop Wilson's Note in Germany

Washington.—President Wilson wants his rejection of the Pope's peace proposals to be read by the German people.

Because the note was indirectly addressed to the German people, appealing to them in the name of democracy and humanity to banish the rule of Hohenzollerism, the President is particularly anxious that the military autocrats of Germany shall be balked in their efforts to keep the message from the people.

Secretary Lansing said today that the Administration was going to take steps to see that the German people were supplied as generously as possible with copies of the peace rejection reply.

It is probable that a systematic plan will be worked out, in co-operation with British and French aviation corps, to send copies of the note into Germany by aeroplane, as was done with the President's war message.

The mascot of the Atlantic Coast Aeronautical Station

AERO CLUB OF AMERICA COMMITTEE COMMENDS AIRCRAFT PRODUCTION BOARD AND SIGNAL CORPS AFTER INSPECTION OF ARMY AERONAUTIC CENTERS

THE committee of the Aero Club of America, which inspected a number of army aeronautic centers has expressed hearty praises of the energetic and able work of the Aircraft Production Board and the Signal Corps.

The committee, consisting of Alan R. Hawley, president of the club; Congressman Hulbert, the energetic and able New York representative, who has been the sponsor of the aeronautic movement in the House of Representatives, and Henry Woodhouse, member of the Board of Governors of the Club, went first to Minneapolis at the invitation of the State and city authorities, has received hearty receptions from the Minneapolis Club, the Athletic Club, the Rotary Club, the Aero Club of Minneapolis and other leading organizations.

The members of the committee asked the many audiences, which were composed of leading men of Minnesota, to stand behind President Wilson and work for large appropriations to train and equip ten thousand naval aviators needed to conduct major aerial operations against the German fleet and U-boat bases. Victory on the Western front will be only half of the fight and the only way to lessen the U-boat menace is to destroy the U-boats in their bases, it was declared.

On every occasion the audiences cheered heartily the advice to stand behind President Wilson and to work to get the Navy Department to train and equip the aviators. The committee made every effort to offset the effect of the anti-draft workers and has succeeded.

Representative Hulbert was loudly applauded when he stated that President Wilson is bearing a greater load than any one man has borne since the resurrection.

The newly organized Aero Club of Minneapolis, which includes in its membership leading men of the city, will continue the work started by the Aero Club of America Committee. Ten thousand dollars was pledged at the meeting toward organizations of the Dunwoody Aerial Coast Patrol unit.

Congressman Murray Hulbert, the energetic and able Representative from New York, whose efforts were largely responsible for the successful completion of the Congressional aeronautic program. In appreciation of his efforts on behalf of aerial preparedness President Wilson presented him the pen with which he signed the $640,000,000 appropriation for aeronautics.

At Omaha the committee witnessed practical demonstrations by Major Henry B. Hersey, the commanding officer of the army balloon school, and other officers, of how Uncle Sam is training aero observers to send to France to direct the fire of the Allies' big guns.

They received a hearty reception by the city and military authorities and the Commerce Club of Omaha, and as a result of their visit and the addresses they delivered there will be organized an Aero Club of Omaha.

In practical demonstration of how the United States trains aero observers, the Messrs. Hulbert, Hawley and Woodhouse were taken up in military balloons to a height of 2,500 feet, where they spotted the bombs exploded at trenches located at from 3,500 to 10,000 yards away. This experience impressed them with the necessity of continuous daily training to make efficient aero observers.

The committee was gratified to find that an efficient system of training has been established and that there had been provided sufficient equipment in balloons and hydrogen plants and quarters where hundreds of aero observers can be trained quickly. A good start has been made and the administrative officers of the balloon section of the army, with the co-operation of Major Hanney and Sergeant Hill, of the British Royal Flying Corps, have developed an efficient system of artillery observation, so that students will be ready for service almost immediately upon their arrival in France. The latest balloon made in the United States on French design, one of which was up when the committee arrived, is actually an improvement on the original, the invention of the French Captain Cagout. It was shown that American manufacturers can now make most efficient balloons.

The committee was glad to find among the advanced students the Columbia and Yale men who became interested in ballooning last winter through the efforts of the Aero Club of America and of the balloon training camp committee of which Mrs. Charles A. Van Rensselaer is the chairman.

The administrative officers of the balloon school includes the following pioneer balloonists: Major Frank P. Lahm, Major Henry B. Hersey, A. Leo Stevens, Captain James Prentice, Captain Frank M. Kennedy, Captain Max Fleischman, Signal Officer Reserve Corps Lieutenant Frank W. Gooddale and Lieutenant Fred A. Post, who operated the captive balloon used by the Russians in the Russo-Japanese war.

The committee arrived at St. Louis on Sunday morning and made an inspection of the Missouri Balloon School, where army balloon observers are trained, and then visited the Scott aviation field, which is twenty-six miles from St. Louis, near Belleville, Ill.

Owing to the need of speed in training aero artillery observers, the Missouri Balloon School is operated on Sundays, and the committee witnessed the inflation and sending off of two balloons loaded with students, who landed several hundred miles away. This balloon school was established by Lieutenant Albert Bond Lambert, pioneer balloonist, who is a member of the Board of Governors of the Aero Club of America, and Mr. Bemis, the president of the Missouri Aeronautical Society. To help the government they bought eight balloons and enlisted all the balloonists available to train army students.

He already has trained sixty-five balloon pilots since May 15. There has been used at this school more than 4,500,000 cubic feet of gas to inflate balloons. Every pilot must make about ten balloon ascensions before he qualifies as a pilot. This is the only school of the kind on the American continent. The army's Omaha school is limited to one or two balloon ascensions a week owing to the lack of gas generators. The first ascension at the Missouri school takes place at half-past five o'clock every morning, and ascensions continue until eleven o'clock in the evening. Night ascensions are part of the advanced training.

The committee went to the new Scott aviation field in the afternoon and were received by Major John W. Heard, commanding officer, and Captain Henry Selden Bacon. This new artillery aviation field is ideally located. It covers 640 acres of fine flat land and is surrounded by miles of flat land, so that if a student should be forced to come down while flying the danger would be minimized.

The hangars, the officers' quarters and the barracks are ready, and within a month one hundred and forty aero cadets will be under training. It is expected that they can train here throughout the winter.

At Dayton the committee was received by Orville Wright, the father of American aeronautics; Miss Katharine Wright, his sister; Mr. Harold E. Talbott, Jr., and other authorities, and visited the Wilbur Wright Field, which is the largest army aviation school in America. To give the committee a better idea of the extensiveness of this new army aviation camp, the members were taken up for flights.

Then the committee, escorted by Major A. R. Christie, the commanding officer; Captain Maxwell Kirby, Captain W. B. Peebles, Captain J. B. McCalley, and other of the able officers in charge of the Wilbur Wright Field, inspected the school and barracks, and the committee was again greatly impressed by the marvelous progress made by the air craft production board and the signal service in quickly putting into operation a chain of huge aviation schools for the training of thousands of aviators needed to strike Germany through the air. The committee is enthusiastic over the progress made and asserts Germany will feel the effect of our aerial preparedness much sooner than she expects.

As one instance of how aeroplane manufacturing facilities are being developed, the committee visited the huge plant of the Dayton Wright Aeroplane Company, at Dayton, which is ready to turn out aeroplanes by the hundred now and will be able to turn out forty aeroplanes per day within six months, if it receives orders large enough to warrant using all its resources. This is the case with several other large manufacturers. The plant of this firm is working with the co-operation of separate large plants for metal and wood parts.

Orville Wright is very busy on some valuable developments in aeronautics. The committee were much impressed by Wright's new work.

Owing to Congressman Hulbert being suddenly called to Washington, the committee had to cut its trip short and could only spend a few hours at Akron, where they were met by the officials of the Goodyear Company and were shown through the Goodyear Flying School and the Goodyear factories by Messrs. E. R. Preston, Lieutenant Maxenfield, U. S. N.; Mr. Lichfield, R. D. A. Preston and Stevens.

Belleville Aviation Camp Ready Soon

The Belleville aviation camp will be ready for student fliers within a short period. Brigadier-General George Squier and Capt. Hall of the United States army recently made a tour of inspection of the field. Both officers expressed approval of the camp work and showed surprise at the results accomplished in the six weeks since the operations began.

Dayton-Wright Co. Increases Stock Issue

The Dayton-Wright Aeroplane Company has filed notice with the secretary of state of an increase in its capitalization from $500,000 to $1,000,000. The increase was due to changes in plans of the company for the manufacture of aeroplane parts, which will necessitate production on a larger scale than was originally contemplated. H. E. Talbott, president of the company, said Thursday.

This company has taken over the new plant of the Domestic Engineering company at Moraine City, and will operate it for the manufacture of aeroplane parts during the period of the war. The company will manufacture all parts of the Standard machine with the exception of the engines.

In Memorium

At a meeting of the Executive Board of the Aero Club of America today, the following resolution in honor of Mr. Evert Jansen Wendell, who died at Paris, France, on August 27th, was adopted:

Whereas, Through the death of Evert Jansen Wendell, which occurred at the American Hospital, Paris, France, on August 27th, 1917, the aeronautical movement and the Aero Club of America have lost one of the oldest, most popular and useful men working in the aerial movement, and

Whereas, From the time of his identification with the Club in 1911 until his death, this wise and foresighted man gave of his time and himself, whole-heartedly to the work of upbuilding the aerial science, and

Whereas, At the time of his demise he was engaged upon an important international mission, having been appointed by the Aero Club of America to establish at Paris its Foreign Service Committee for the purpose of serving the interests of American aviators and aeronauts abroad and informing their relatives and friends at home of their circumstances.

Therefore, Be It Resolved, That in expression of our deep sorrow at the loss of so valuable an associate, we emphasize our unbounded admiration for those qualities of heart and mind which made him so invaluable a member of the aeronautical community, and

Be It Further Resolved, That a copy of these resolutions properly engrossed, be presented to his family.

Harry L. Barnitz to Co-operate with War Department

The Aviation Section of the War Department has secured the services of Harry L. Barnitz, the well-known authority and consulting engineer on the subject of Hydrogen.

Mr. Barnitz will act in the capacity of civilian adviser whenever the department requires such services. Mr. Barnitz is the author of several articles on the production and application of hydrogen, which are printed in booklet form, and have been adopted as text and instruction books by the U. S. Signal Corps Aviation Balloon School at Fort Omaha, Neb.

The Library of Congress at Washington, D. C., has awarded Mr. Barnitz an honorary certificate in appreciation of his various technical writings on the subject of hydrogen.

Many technical men interested in this subject are looking forward for the publication of a book which he expects to have ready some time during the winter, on the Modern Production and Application of Hydrogen.

Work Commenced on Dallas Field

The selection of Dallas as one of the Government sites for an aviation school was announced by Mayor Joe E. Lawther, who recently headed a committee to Washington, and by Chamber of Commerce and Manufacturers' Association officials. They said it means the immediate building of a small city north of Dallas.

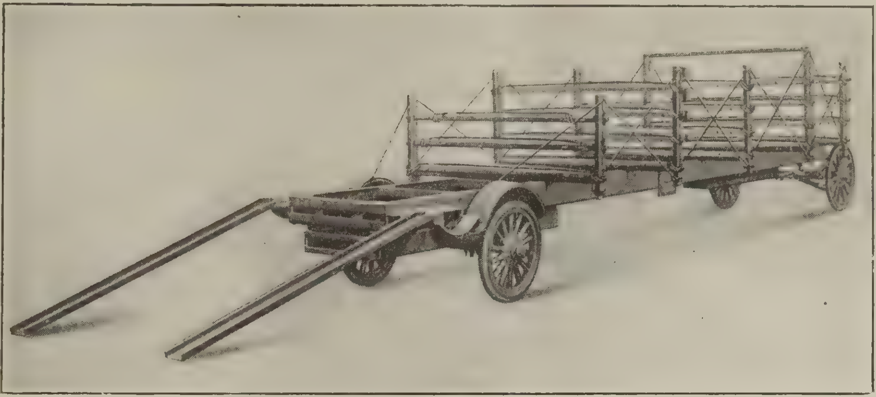
Work is to begin at once on the buildings and a total of $750,000 is to be expended here. There will be more than 900 men, mechanics and aviators at the school, which will accommodate at least 1,000 students. Most of the students will be expert mechanics at the time they start into the training. Several of the world's foremost aviators will be here to train the men. A supply plant will be established on the site and in every way the 640 acres leased by the Government will resemble a little town.

A lease has been secured on the land for three years. The Government, in securing the leases, also secured options that may result at any time in the property being purchased outright. Local men who helped secure the camp for Dallas expressed the opinion yesterday that even if the war should end within three years, by that time aviation will have increased to such an extent that private owners would be glad of the opportunity to take over the Government property, if it should be considered by the Government that the camp should be abolished.

New Ericsson Plant

The Ericsson Manufacturing Company, of Buffalo, N. Y., has just broken ground for an addition to their plant. The new building, which will start manufacturing in October, will enable the doubling of the plant's present productive capacity. This 100 per cent increase in manufacturing facilities has been necessitated by the great demand for the Berling Magneto, which is now the Ericsson Manufacturing Company's main product. Plans for further extension over part of the 13½ acres still remaining on the Ericsson property are now under consideration.

The Berling Magneto was first adopted on the Curtiss aeroplanes. With it, Victor Carlstrom made most of his records for height and distance. In a short time, the motorboat industry had discovered the qualities of the Berling Magneto and the greatest of the marine-engine manufacturers—including the Sterling, Van Blerck and a half dozen others—adopted the Berling Magneto. The result was that most of the records for endurance have gone to the credit of engines equipped with the Berling. When the Express Cruiser Countess ran 187 miles in 7¼ hours, the Berling furnished the spark for the motor.



The Trailmobile Trailer for hauling aeroplanes—the product of The Sechler & Co., Cincinnati.

The motorcycle fields soon adopted the Berling. The Henderson motorcycle was the pioneer. Last month a Berling-equipped Henderson clipped three days off the transcontinental motorcycle record. The Berling is now standard equipment on six of the most important motorcycles made in America.

The enlargement of the factory now going on is a direct result of the increased business that has come to the Ericsson Manufacturing Co. almost without solicitation, simply because the magnetos that were put on the market made good.

Glenn Curtiss, inventor and developer of the Curtiss aeroplane, recently said this in regard to the Buffalo-made Berling Magneto:

"In response to your request for my personal opinion of the Berling Magneto, I can earnestly say that the high quality of your product has been the most important factor in the successfully rapid development of our aeronautical motors during the past few years.

"With the foreign supply of magnetos shut off from this country, it was imperative to the success of aviation in this country that a magneto be developed equal to the rigid requirements necessary. I believe that in your product we have an equal, if not a superior, article to those which were being supplied to us by foreign manufacturers, and by their continual use on our motors, have proven them equal to the demands of our customers."

A Correction

In our issue of August 13 page 770, in a news item headed "Fisher Body Co. to Manufacture Aeroplanes" we stated that the machine to be constructed was the Dayton-Wright. This should have read the "Standard J-1 machine." In addition to the Fisher Body Co., the Dayton-Wright and Wright-Martin Co. are manufacturing Standard aeroplanes.

U. S. Naval Reserve Sends Out Call for 10,000 Aviators

A call for 10,000 naval aviators for service against Germany was issued by the United States Naval Reserve Force. At the reserve headquarters, 280 Broadway, New York City, it was predicted that the new order foreshadowed a vigorous air campaign against the U-boats.

"The aviators are wanted at once to fight the undersea boats of Germany," said an official at headquarters. "I understand that they will also be used to 'smoke out' the German high-seas fleet, which has been lying in the Kiel Canal for such a long time. At any rate, the men who qualify and pass through the course of training will see action as soon as they are competent."

Men skilled in the flying of aircraft and unskilled men, who will enroll as students, are alike demanded for the new air force. The candidates must be eighteen years old, must have a fundamental education and must be of the alert type. A college education is not at all essential, it was emphasized yesterday, but applicants who possess it will be given the preference.

Naval aviation training stations on Long Island have been largely increased to take care of the numbers it is expected will answer the call. No stated time for the course of training has been set, the students receiving commissions as soon as they are thought fit by their instructors.

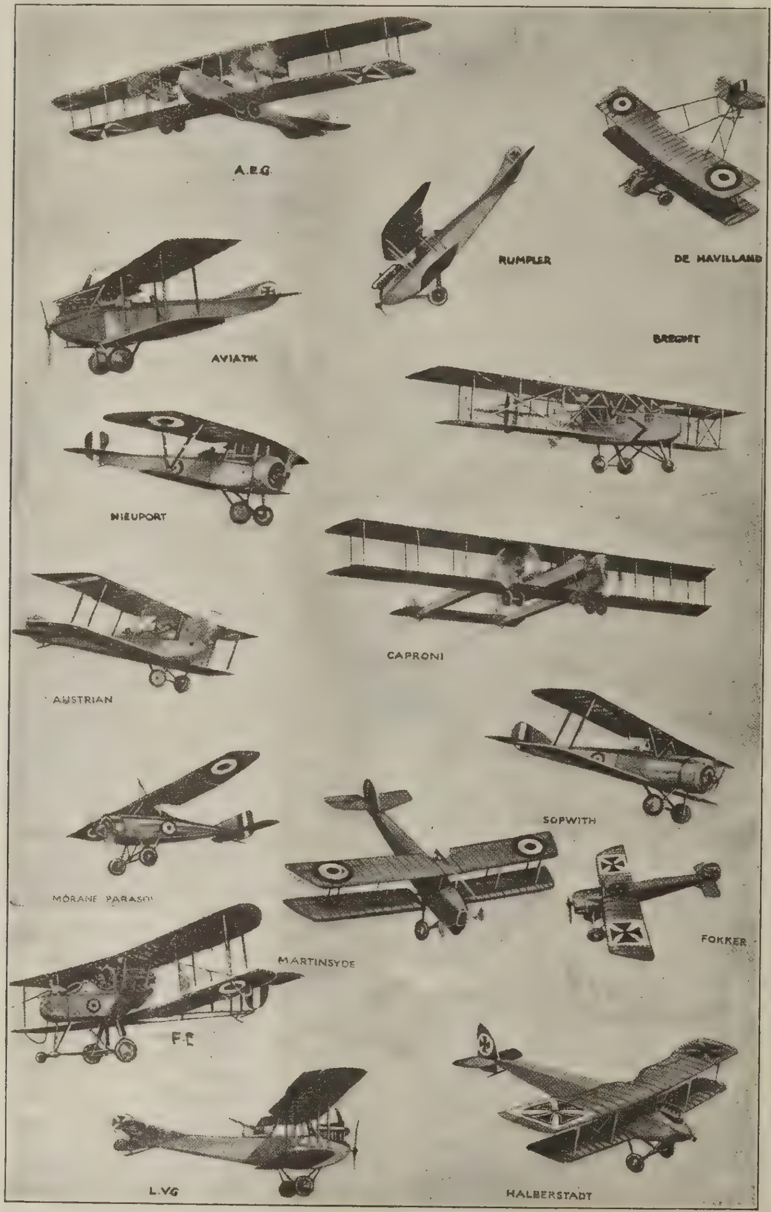
Besides the aviators there are also needed men skilled in the design, building and operation of aircraft, who have an opportunity to obtain commissions for duty as assistant inspectors of engineering material (aviation engines and parts), flight instructors and expert aids, such as aviation motor experts, design experts and electrical experts.

Camp Whitman at Beekman May Be Used to Train Fliers

Poughkeepsie.—That Camp Whitman, at Beekman, which was prepared earlier in the season for the mobilization of many thousand Federal troops, will be used as an aviation ground for the United States Government is intimated strongly by military men in position to know. The news received here is that there will be established at Camp Whitman an aviation school as large as that at Hempstead, L. I. Adjt.-Gen. Stotesbury is known to be hopeful that such a use will be made of the broad acres which Camp Whitman covers.

Camp Whitman is eighteen miles from Poughkeepsie, on the line of the Central New England Railroad, a line fed by the New York Central at Beacon and Dutchess Junction. It is exactly seventy miles from the Grand Central Terminal.

Group of army students of the army aviation fields



Group of battleplanes, reconnaissance machines, and speed scouts in use on the war fronts in Europe. Photo courtesy The Aeroplane (London).

Launching an F. B. A. flying boat at an Italian naval aeronautic station.

Standard Development

The Standard Aero Corporation has just announced the purchase of the J. G. Brill Car Works, in Elizabeth, which marks the greatest development of the history of this corporation. The property itself represents a cost of $750,000, and it is estimated, including equipment, the total cost of the plant before beginning operation will be $1,000,000.

Present plans call for employing between 4,000 to 6,000 people at the new plant, a good percentage of whom will be women. It is noteworthy that the Standard Aero Corporation is the first aeroplane corporation to use women on a large scale in the manufacture of planes. At the new plant, it is expected to carry women help much further into the processes of manufacture.

The present plans of the corporation include the continued operation of the Plainfield plant in connection with the Elizabeth plant, and also, the maintenance of the executive offices in New York.

It is also expected that the six manufacturers now working on parts manufactured for the company, will continue to do so.

Standard Aero Corporation has had greater growth than any other aeroplane company in the country during the last year, starting with some fifty men less than a year ago, and at the present time employing upwards of 16,000 men in the State of New Jersey, and the new plant will within three months be operating a force of at least 3,000 people.

The important factor in the building of the Standard organization has been its personnel.

Mr. Charles H. Day, prominent aeronautical engineer, is the chief engineer and designer. Mr. Day was the inventor of the first tractor biplane, building both the plane and the engine, of the rotary type. He, himself, flew this machine on its first flight, which was very successful. From 1910 to 1911, Mr. Day was with the Glenn Martin Co. as chief engineer and designer. During 1912, he entered the manufacturing business and designed and manufactured his own biplanes. He later sold out to Glenn Martin and went back with them in 1913. He spent the next year in experimental work for himself, and in 1914 he joined the Aircraft Company which later became the Sloane Manufacturing Co., and is now known as the Standard. Mr. Day is designer of the H-3, J, J-H, and Speed Scout.

Mr. C. V. Bradford, general manager of the company, was for seven years connected with the American Tobacco Co., in charge of manufacturing of their cigarette factories. He spent three years of his time with the company in Cuba, where he erected one of the largest cigarette factories in the world, turning out 11,000,000 cigarettes a day. He was general manager in charge of this work. For two years he was connected with the United States Metal Products Co., of Long Island, constructing metal window trims, etc., and was general manager of the construction work of all fireproof doors and windows on the Woolworth Building, Ritz-Carlton Hotel, etc. The operation of this company during the absence of the president is in the hands of Mr. Bradford.

Mr. D. L. Meenan, at present time, director and treasurer of the company, joined the Aircraft Company in 1914 as secretary and treasurer. Later he became assistant secretary of the Sloane Manufacturing Co. When the organization became the Standard Aero Corporation, Mr. Meenan was elected director and treasurer.

Mr. E. E. Pennewill has been well known in Philadelphia in the sales and manufacturing end of large business. For four years he acted as sales manager of the Thomas Robert Stephenson Co., and for two years assistant to vice-president in charge of sales of the Cramp Shipbuilding Co. Mr. Pennewill is in charge of manufacturing at the Standard plant and has instituted many novel and labor saving devices.

Mr. H. C. Daych, in charge of advertising and the company personnel, was for three years executive secretary of the Advertising Club of New York, and previous to that, connected in an advertising and editorial capacity with several publications.

Mr. E. H. Shoemaker, in charge of the statistical department, is well known as captain of the University of Pennsylvania Varsity Crew previous to his graduation. He was connected with the Pennsylvania Railroad Co., New York Central Railroad Co., Liquid Carbonic Co., and finally, assistant secretary and treasurer of Compressed Gas Manufacturers' Association.

Mr. Charles G. Straat, chief accountant, has been connected with leading certified public accountants in New York City for the past seven years as senior account.

Mr. R. C. Taylor,. present executive at headquarters in charge of field work, was for seven years connected with the firm of Johnson & Johnson, and for eleven years up to his connection with the Standard Company was manager of the Chicago office of the same company.

The Standard Aero Corporation looks to the excellence of its personnel for a future growth equal to its past. Mr. Harry Bowers Mingle, president, will have as his task the molding together of these personalities, as he has done in the past. Mr. Mingle will be in charge of the operations of the corporation. He is the sole stockholder. It has been due to his dynamic forces and inspiration that the organization has grown from the small company it was.

ARMY AND NAVY NEWS

Signal Reserve Corps

Maj. F. B. Jewett and Capt. E. B. Craft to Washington, then to their stations.

1st Lts. S. M. Clement and R. MacDonald, Av. Sec., will report to Chief Sig. Officer.

Maj. J. L. Ord hon. discharged.

Capt. R. Marsh, Jr., will report to Chief Sig. Officer.

1st Lt. E. L. Thomas, Av. Sec., to Ft. Sam Houston.

Capt. J. J. O'Connell, Av. Sec., to Fairfield.

The following board of officers appointed to meet at Army Balloon School, Fort Omaha, to examine candidates for appointment in Junior Aeronaut Grade:

Hersey, Maj. Henry B., Av. Sec., Sig. O. R. C.; Capt. J. Prentice, Av. Sec., Sig. C., and 1st Lt. F. W. Scott, M. R. C.

Gould, 2d Lt. H. A., Vet. O. R. C., to Camp Grant, Rockford.

Howell, Maj. J. A., Judge Adv. Gen. O. R. C., to Camp Kearny, Linda Vista.

Roscoe, Capt. D. L., Av. Sec. Sig. C., to Toronto.

Signal Reserve Corps

The following officers of Av. Sec. announced on regular aerial duty:

Bartholomew, 1st Lt. R.; Norton, 1st Lt. D. S.; Gonya, 1st Lt. G. F., and Lindsay, 1st. Lt. D. B.

O'Connell, Capt. J. J., Av. Sec., to Toronto.

Goldblatt, 1st Lt. B., Av. Sec., to Toronto.

Buscall, 1st Lt. D. C., to Washington.

Cane, 1st Lt. B., Av. Sec., to Ft. Sam Houston.

Bull, 1st Lt. W. F., Av. Sec., to Cornell University.

Williams, 1st Lt. M. N., to Berkeley (Cal.) School of Mil. Aeronautics, University of Cal.

Nourse, 1st Lt. C. J., Av. Sec., to active duty.

Milburn, Capt. J. D., relieved of orders of Aug. 24.

Fowler, Maj. H., Av. Sec., to active duty.

Fisher, 1st Lt. R. T., Av. Sec., to Ft. Sam Houston.

Capt. Frank H. Maguire, Av. Sec., S.O.R.C., to duty at Fort Sam Houston, Texas. (Aug. 20, War D.)

First lieutenants of Av. Sec., S.O.R.C., to duty as follows: Lawrence B. Brady and Joseph H. Hyman to Fort Sam Houston, Texas; Everett A. Lee to Fort Sam Houston, Texas; DeWitt J. Payne to Washington with the C.S.O.; George M. Church to Av. School, Fairfield, Ohio; Walter W. King to the Wilbur Wright Field, Fairfield, Ohio; E. A. Coleman to Washington with C.S.O.; Charles E. Cotting, jr., to Fort Sam Houston, Texas; Arthur W. Betts to Fort Sam Houston, Texas. (Aug. 20, War D.)

First lieutenants of Av. Sec., S.O.R.C., to duty as follows: Junius A. Richards to Aviation School, Mount Clemens, Mich.; Shirus A. Blair to Fort Sill, Okla.; Eugene Behrendt to Belleville, Ill.; Edward T. Jones to Detroit, Mich.; Reynolds Benson to Aviation School, Fairfield, Ohio; William H. Murphy to Fort Sam Houston, Texas; Joseph W. Ramsay and L. Theo Bellmont to School of Military Aeronautics, University of Texas, Austin; Leon L. McGrady to School of Military Aeronautics, Massachusetts Institute of Technology, Boston; Henry D. Lindsley, jr., to Aviation School, Fairfield, Ohio; Willis A. Boggs, jr., to Fort Sill, Okla., School for Aerial Observers. (Aug. 20, War D.)

Capt. Melvin B. Ericson, Av. Sec., S.O.R.C., to active duty with War College Division, G.S. (Aug. 21, War D.)

Capt. Charles R. Cameron, Av. Sec., S.O.R.C., to duty at Washington. (Aug. 20, War D.)

First lieutenants of Av. Sec., S.O.R.C., to duty at Fort Sill, School for Aerial Observers: Lewis W. Stevens, Raymond E. Vaughn, Thomas J. D. Fuller, jr., Murray McConnell and John H. Baker. (Aug. 20, War D.)

First Lieut. John J. O'Rourke, Av. Sec., S.O.R.C., to duty at Fort Sam Houston, Texas. (Aug. 20, War D.)

First Lieut. Harold M. Sanford, Av. Sec., S.O.R.C., to duty at Wilbur Wright Field, Fairfield, Ohio. (Aug. 20, War D.)

First Lieut. Philip D. Smith, Av. Sec., S.O.R.C., to duty at Aviation School, Rantoul, Ill. (Aug. 21, War D.)

Capt. Robert D. Wrenn, Av. Sec., S.O.R.C., to report in person to C.S.O. of Army for duty. (Aug. 22, War D.)

Capt. Henry S. Bacon, Av. Sec., S.O.R.C., to duty at Aviation School, Belleville, Ill. (Aug. 22, War D.)

Capt. John W. Swann, Av. Sec., S.O.R.C., to duty with Chief S.O. of Army. (Aug. 22, War D.)

Capt. Frederick C. Bahr, Av. Sec., S.O.R.C., to report to Chief S.O. of Army for duty. (Aug. 22, War D.)

First Lieut. Joseph D. Beggs, Av. Sec., S.O.R.C., to duty at Princeton, N. J. (Aug. 22, War D.)

Second Lieut. Edwin Mott has resigned from the Infantry O.R.C. to enter the Aviation Section of the Signal Corps.

Hughes, Herbert, Capt., 6-25-17, Grosse Point, Mich.

Marmon, Howard C., Capt., 6-26-17, Indianapolis, Ind.

Weinsten, Henry, 1st Lieut., 7-10-17, Goshen, Ind.

Smith, Harry M., 1st Lieut., 7-10-17, Chicago, Ill.

Langley Field, Va., Now Permanent

The Aeronautical Experiment Station, Langley Field, Hampton, Va., is announced as a permanent military station and designated "Langley Field, Va."

Signal Reserve Corps

1st Lt. E. A. Bryan, Av. Sec., to participate in flights.

Capt. H. S. Bacon, Av. Sec., to Belleville.

Capt. J. W. Swann, Av. Sec., to office of Chief Sig. Officer.

Maj. C. P. Bruch, to report to Chief Sig. Offier.

Capt. R. D. Wrenn, Av. Sec., to report to Chief Sig. Officer.

1st Lt. A. F. H. Scott, Av. Sec., to Hampton.

1st Lt. J. V. Burne, Av. Sec., to Fort Sill.

1st Lt. J. D. Beggs, Av. Sec., to Princeton as supply officer.

Capt. F. C. Bahr, Av. Sec., to active duty.

1st Lt. E. T. Jones, Av. Sec., to active duty at Plainfield, then to Detroit.

1st Lt. E. Behrendt, Av. Sec., to Belleville.

Capt. M. B. Ericson, Av. Sec., to report to Chief of Staff.

1st Lt. N. Levenson, to New York.

1st Lt. P. D. Smith to Rantoul, Ill.

1st Lt. E. J. Steichen, to Rochester.

1st. Lt. J. J. O'Rourke, to Ft. Sam Houston.

1st Lt. R. E. Vaughn, to participate in flights.

1st Lt. H. H. Sanford, to Wilbur Wright Field, Fairfield.

1st Lts. R. Bartholomew, D. S. Norton, and D. B. Lindsay, to participate in flights.

1st Lts. L. W. Stevens, M. McConnell, T. J. D. Fuller, R. E. Vaughn, and J. H. Baker, to Ft. Sill, School for Aerial Observers.

Capt. Courtney P. Grover, Medical Reserve Corps, is assigned to active duty and will proceed to Fairfield, Ohio, and report in person to the commanding officer, Flying School, Aviation Section, Signal Officers' Reserve Corps, that place, for duty as post surgeon and by letter to the commanding general, Central Department.

The assignment by the Surgeon General of the Army of Capt. William A. Jackson, Medi-

(*Continued on page* 971)

Seek Enemy 'Planes in Utah.

Salt Lake City, Utah—Suspecting that enemy aviators have been flying over southern Utah, Leon Bone, special investigator for the Department of Justice, has asked the War Department to send aeroplanes to this State to make an investigation of the reports which have come from San Juan and other counties, as to nightly flights. Mr. Bone said that it is impossible for persons on foot to determine the headquarters of the aeroplanes, and that as a last resort the machines of the War Department have been asked to aid in the search.

Agents of the Department of Justice assert that it is their belief that information obtained through these aeroplanes is sent to enemy countries by way of Mexico.

A group of patriotic St. Louis citizens who are doing excellent work in connection with the St. Louis Balloon School. In the center, in uniform, is Mr. A. B. Lambert, the guiding spirit of the work

RISKY FLYING WEATHER

By PROFESSOR W. G. DUFFIELD, D. Sc.*

As every airman knows, there are days when the air is calm and clear and free from bumpiness, there are no clouds above to obscure the sun and no fog or mist below to hide the earth. Above the earth the breeze probably freshens and perhaps veers a little, but it is scarcely strong enough to affect a cross-country flight, for which a compass course has been set before climbing into the air. On other days the conditions are the reverse of this, the air is bumpy and variable, clouds in the upper levels prevent bearings being taken from the sun, rain clouds may settle on the face of the earth, and provide fresh anxieties, or a breeze may rapidly develop into gale force and make progress against it difficult and flying precarious. On other occasions a sudden squall of rain and wind may find an airman unprepared and force him to land, the most dangerous type being known as a line-squall.

The study of meterology may help a pilot in two ways, first by informing him of the approach of weather in which it is likely that flying will be risky, for which purpose he will require a serviceable barometer and the daily weather map issued by the Meteorological Office, and, secondly, by making him fully acquainted with the nature of the difficulties he is likely to encounter, because if he knows what to expect he will be able to watch for it and to be prepared.

Gradations of Weather

There is an insensible gradation between good flying weather and bad flying weather. There seems at first sight to be no obvious reason why some days are good and others bad. In the eyes of some people the sequence of weather is an unfathomable mystery; the weather for any particular day is regarded as being doled out in a haphazard fashion—a fine day today perhaps, a wet one tomorrow maybe, and a close, muggy day on Wednesday, and so on. The study of meteorology shows that the weather is not fortuitous, but that the sequence of weather obeys the ordinary physical laws of nature, there is no room for superstition about it—it would be just as impossible to alter the weather which will affect these islands tomorrow as it would be to alter the law of gravitation and make the water flow uphill.

The system which is most frequently responsible for bad flying weather is the depression or cyclone. As we have already seen in a previous article, this may be described as a gigantic eddy which sweeps over the country, usually coming up from the west or south-west and making off in an easterly direction; it carries a system of winds with it which are experienced in succession as it traverses the country. In the northern hemisphere the whirl of air at the ground level is that shown in Fig. 1, in which the closed curve represents the disturbed area, which is always one in which the barometer stands low, and the arrows denote the direction in which the wind is blowing. It is obvious that the sequence of winds varies according to the position of the observer with reference to the track of the centre of the depression, which is represented by the large arrow on the diagram. If the airman is north of this track the wind first experienced comes from the south-east, and this gives place to an easterly wind, which gets more north in it a little later until it blows from the north or even from the north-west as the disturbance passes away. These changing winds are said to be "back," because they go contrary to the direction in which the sun sweeps across the heavens in these latitudes, contrary, therefore, to the motion of the hands of a watch. To avoid confusion a "backing" wind in the southern hemisphere, where, of course, the sun goes from east to west via the north, is nowadays always referred to the hands of a clock and not to the sun's motion, so that all over the globe a backing wind is like that represented in Fig. 2, in which the wind changes from S.E. to E., to N.E. to N.

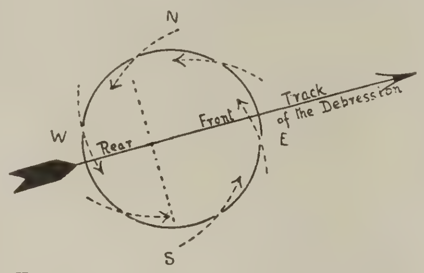


FIG. 1.—The winds in a depression. The arrow shows its track across country.

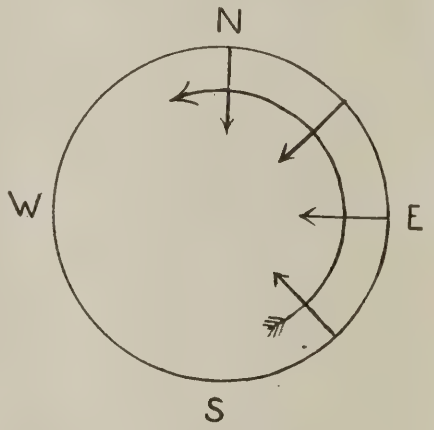


FIG. 2.—Backing winds.

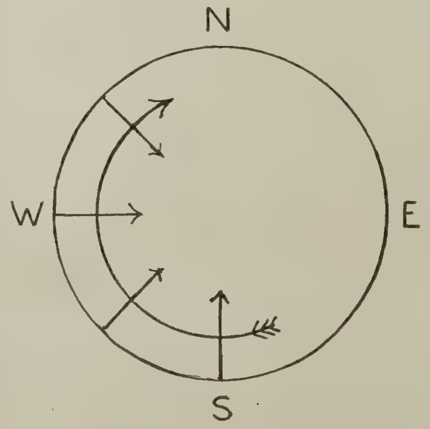


FIG. 3.—Veering winds.

"Veering" Winds

The southern part of the depression provides a different series of winds; as the disturbance proceeds across the country the south wind, which was characteristic of the advancing part, gives way to a wind from the south-west, which changes to west and finally to a north-westerly wind. This sequence of winds is represented in Fig. 3, and as the change is clockwise (or with the sun in the northern hemisphere) the winds are said to "veer." By noting whether the winds are veering or backing it is possible for an airman to tell on which side of the disturbance he happens to be. In the southern part of the British Isles and in France he usually finds himself on the south side because the track of a cyclonic disturbance is more frequently further north, but this is by no means the invariable rule. As far as the gustiness of the wind is concerned and the probability of meeting a sudden squall it is a distinct disadvantage to be on the southern side of the track of the centre.

In the front of the depression the winds are usually light, but they increase in strength as the barometer approaches its lowest reading, and we frequently find instances of great gales occurring in the middle and rear portions, though the area in the actual centre of it may be calm.

It depends very much upon the height of the barometer in different parts of the cyclone where the most violent winds will be found. The cyclone or depression is, of course, a region of low pressure, about which the winds swirl in a gigantic eddy, the barometer stands lowest in the centre, but around the central part the barometer does not change at the same rate. Where the barometer falls most rapidly in a short distance the winds are strongest, and as this usually happens south of the centre of the track, that region provides the most troublesome weather for aeroplane work, weather which makes lighter-than-air craft stay within their hangars. The severity of a storm of this nature always depends upon the rate at which the barometer is falling. After the centre of the disturbance has passed the barometer, of course, rises again—very often with rather a sudden jump, but the strong winds continue for some time after this.

The Cyclone

The changes in the appearance and the cloudiness of the sky are represented in Fig. 4, which is based upon Abercromby's almost classical description of a cyclone. The right-hand part is the front of the disturbance, and is generally characterised by a watery sky, which sometimes gives us a ring round the sun or the moon; as the depression advances the cloudiness increases, a very frequent accompaniment of a falling barometer, and as the clouds gather the sky becomes more and more overcast and gloomy, and it soon begins to drizzle. As the disturbance sweeps onward the drizzle changes to rain, which is at first ill-defined, but very often of a heavy nature as the centre passes over the country. After a few hours the overcast sky gives place to detached masses of cloud which provide glimpses of a blue sky beyond. There are still further squalls or showers of rain, but they are, as a rule, heavy and distinct from the fine drizzle and desultory rain which are a feature of the forward part of the depression. These showers are often called clearing showers, and as they become less frequent and less severe, the blue sky begins to prevail, and as the disturbance rolls along the clearness of the air becomes a distinctive feature; the rain has brought down with it most of the dust particles, which, as a rule, obscure the landscape and produce a haze which prevents good seeing.

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*From Flying (London).

The above is the sequence of events as far as they depend upon the presence of water vapour in the atmosphere.

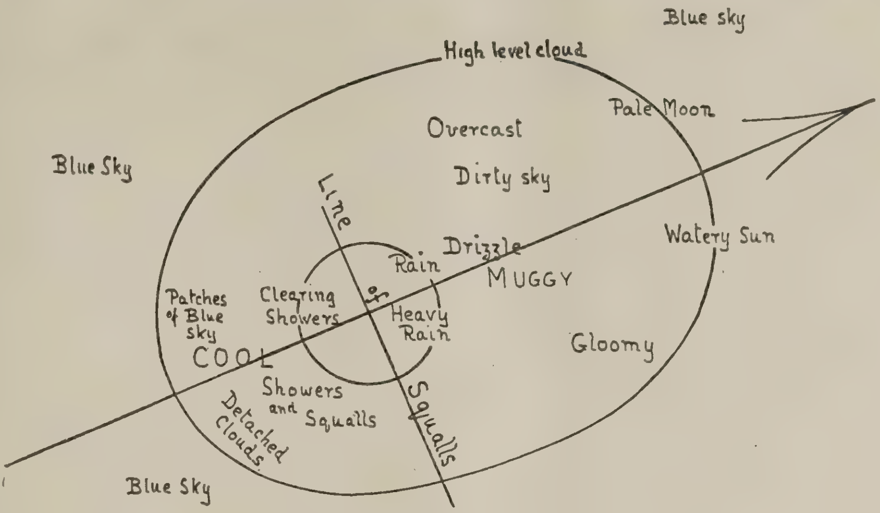

FIG. 4.—The weather in a depression.

In Front of the Depression

One feature of a depression is very striking, and that is the difference in the "feel" of the air in the front and in the rear. Abercromby has remarked upon the distinction between the two halves and the fact that all cyclones invariably show it. As the system approaches, the advanced part is marked by the warm and depressing character of the weather and a general mugginess prevails. Abercromby's original chart emphasises the oppressive feeling induced by this part of the disturbance, by introducing the words "neuralgia," "wounds," "drains," "rheumatics," "corns," to signify that then is the time when these ills obtrude themselves most emphatically upon human attention; and to indicate that the gloomy feeling extends to the lower orders, he adds the words "restless animals." The mugginess seems to be occasioned by the combined effect of a rising temperature and a falling barometer and the increased humidity of the air. There is generally a feeling of uneasiness as the barometer falls, because it means that certain things which had been obsorbed by the fluids of the body when the atmospheric pressure was high, come out of solution, and it takes some time for the readjustment of the system.

Behind the Depression

Very different is the weather in the rear of the depression. After the central region has passed the temperature falls and it becomes cooler, due partly to the fact that the wind is now coming from a northerly instead of a southerly point, and naturally polar winds are cooler, and partly to the fact that the air in the rear is flowing downwards from above, where the strata are cooler. There is a crisp feeling in the air which exhilarates, and, added to this, the gloom of the overcast sky is dispelled by glimpses of blue sky and by sunshine. Abercromby, whose description of a cyclone or depression is very complete and graphic, remarks that the adage, "do business with men when the wind is in the north-west," arose from the fact that it is in the rear of a depression that the north-westerly breeze comes as so marked a relief after the oppressive nature of the preceding hours.

A Good Weather Service

From what has been said about the depression, it should be clear that it has two pronounced features which enable an airman to be aware of its approach, first the fact that the barometer falls as it advances and, secondly, the fact that it begins with southerly winds, which usually "veer," but which sometimes "back" if the observer is to the north of the path along which its centre passes over the country. The mugginess of the weather should provide another sure sign of its approach, and if he is able to see a weather map he would be able to make absolutely certain, as we shall see later. The whole disturbance, which is often of much greater extent than the area of these islands, may have come and gone in the space of less than twenty-four hours, and as it is a very frequent visitor to these shores a good weather service is indispensable for the development of aviation.

We reserve for later consideration a description of the type of squall which is sometimes associated with the passage of the centre of the cyclonic disturbance, but enough has been said to make it plain that the whole system is one which is unfavourable for flying.

Naval students being instructed in the "tuning up" and handling of a training seaplane

THE SCREW PROPELLER IN AIR*

By M. A. S. RIACH

Introduction

At the present time there does not appear to be any really adequate theory of the airscrew. The only theory that has been developed recently is the one given by Mr. F. W. Lanchester in a paper to the Institution of Automobile Engineers in April, 1915.† This paper is, moreover, admittedly based on certain theoretical conceptions, and not directly upon aerofoil data obtained from wind channel tests. I have always believed in the possibility of successfully applying aerofoil data to propellers, and any method that attempted to co-ordinate the results of wind channel experiments on model aeroplane wings and on model airscrews appeared to me to be worthy of every encouragement.

It was for these reasons that the so-called blade element method of propeller analysis, in the first instance enunciated by S. Drzewiecki and later developed by Mr. F. W. Lanchester in his work "Aerial Flight," appeared to me to be a step in the desired direction, and the few experiments carried out at the National Physical Laboratory to test the accuracy of the theory, and as published in the Report of 1912-13, led me to believe that the method might with advantage be developed analytically so as to form a reasonably sound basis for the comparison of experimental results and to give to the designer a fairly clear outlook upon the subject. It has always appeared to me that, when testing any theory, however empirical, a distinct advantage is obtained by first stating the whole of the premises, and, having got these clearly defined, to work out the results of the initial assumptions to their extreme logical conclusions. However approximate a theory may eventually turn out to be, it saves time in the long run to fully develop the theoretical aspect of the subject which is often capable of outlining new methods of attacking the problem, even when the original conceptions upon which the theory was based have been shown to possess no longer a sufficient degree of exactitude.

As an example of this, I might quote the great importance of pitch-ratio upon efficiency in the design of airscrews, and it is difficult to see how such a conclusion could have been arrived at without the help of such analysis as that proposed. As a consequence I was let to investigate the subject from the point of view of the blade element theory, and the results so obtained are given in my book "Airscrews."‡

With the information now available upon the subject it has been found that this method is not sufficiently accurate even for the comparatively "rough-and-ready" methods of commercial propeller design, where the employment of empirical correction factors has been found to be necessary, and although it will probably be found that the theory is still quite a good guide, and, if employed in conjunction with the correct correction factors, may usually be trusted to give quite sufficiently accurate results for the ordinary "hack" propellers demanded of the designer in commercial design work, yet, viewed from the much more rigid standpoint of the degree of accuracy obtained in a laboratory experiment, it must be confessed that the method still leaves much to be desired.

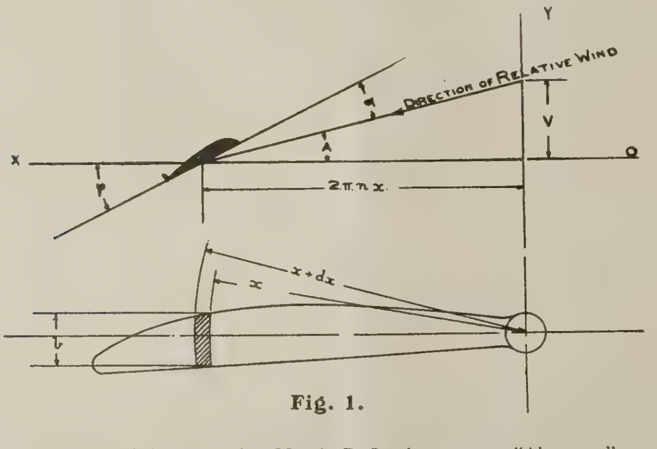

Fig. 1.

Many will probably remember Mr. A. R. Low's paper on "Airscrews" read before the Society in April, 1913. In the discussion which followed the reading of this paper, Mr. Handley Page pointed out that Mr. Low had dealt with the propeller problem from the point of view of what happens to the air as it passes across the blade, considered on the assumption that the blade elements were entering undisturbed and non-accelerating air, and that in reality it did not by any means follow that the lift coefficients and lift-drag ratios taken for the section as tested as an aerofoil in a wind channel would be identical with the results obtained when the section formed part of an airscrew blade revolving in a helical path and encountering disturbed air, and that in consequence the coefficients would require modifications to accord with practical results obtained. This, Mr. Page went on to say, really constituted the second half of the problem, and dealt with the question from the point of view of the slip stream on the basis of the Rankine or Froude theory. He expressed the opinion that there should be no antagonism between the two methods of design, but that they should rather be used in conjunction for the correct determination of all the constants of the propeller blade.

It was with a view of co-ordinating these two methods of attacking the problem that led me some time ago to consider whether an advance might not be obtained by utilizing both of these theories in an attempt to take into account certain factors ignored in both methods considered separately, and by which the determination of some of the empirical constants used in practical design could be brought about, with the result of more closely co-ordinating theory and experiment. Before entering upon a detailed discussion of the propeller theory given in this paper, I propose to commence with the formal presentation of the problem, as conceived by the majority of writers upon the subject, notably Rankine and R. E. Froude, and as given in standard text-books on the screw propeller of marine engineering practice. The subject is by no means a non-controversial one, the theory advanced by Mr. R. E. Froude in his papers read before the Institution of Naval Architects in 1889 and 1911 having been violently attacked by Prof. Henderson in discussion of these two papers and in his own paper of 1910.

General Analysis

Let:—

$V =$ the speed of advance of the screw relative to the undisturbed fluid.

$V + V_1 =$ the speed of the fluid at the actuator disc relative to the screw.

$V + V_1 + V_2 =$ the speed of the fluid after passing through the actuator relative to the screw.

$M =$ the mass per second of the fluid through the actuator.

Then, according to R. E. Froude, the thrust on the screw is equal to.

$$M \, . \, (V_1 + V_2),$$

and the useful work done per second is equal to

$$M \, . \, (V_1 + V_2) \, . \, V,$$

and the total work done per second is equal to

$$M \, . \, (V_1 + V_2) \, . \, (V + V_1),$$

and therefore the efficiency is given by

$$\frac{V}{V + V_1}, \text{ and also } V_2/V_1 = 1,$$

i.e., one-half the acceleration takes place in front, and one-half behind the actuator.

But, according to Prof. Henderson, the acceleration ahead of the actuator does not contribute to the thrust of the screw, but forms part of a conservative system, and that in consequence the thrust, work and efficiency are given by:—

Thrust $= M . V_2$

Useful work/sec. $= M . V_2 . V$

Total work/sec. $= \frac{1}{2} . M . [(V + V_1 + V_2)^2 - (V + V_1)^2]$

and therefore efficiency $= \dfrac{V}{V + V_1 + V_2/2}$

values of V_1 and V_9 for each radius along the blade the foregoing theories are insufficient for the practical design of airscrews, and in consequence one is forced to experiment and its corresponding empirical methods.

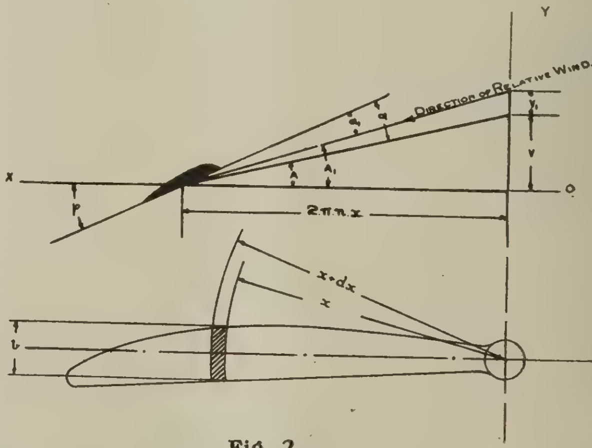

Fig. 2.

The Blade Element Theory

The most generally accepted theory of the airscrew at the present time is the one in which the reactions on the blades are calculated from the reactions on elementary strips of the blade, determined on the basis of experimental work carried out in wind channels on aerofoil sections. In this method certain empirical "correction factors" have been found necessary in order to bring calculated results into agreement with those obtained by experiment. It is usual to make allowance for these correction factors either at the commencement or at the end of the analysis in the practical design of airscrew blades. The method of analysis is briefly as follows:

Let Fig. 1 represent a section in plan and elevation of an airscrew blade cut off by two concentric radii of (x) and $(x + dx)$ respectively.

Let the angle made by the chord of the section with the direction of rotation, or disc of revolution, be denoted by (ϕ).

Let the airscrew have an axial velocity of (V) in the direction of OY, and let it have a revolution speed of (n), so that the axial advance per revolution is (V/n).

Let the angle of the effective helix be (A), and denote the angle $(\phi - A)$ by (a), which may then be called the "apparent angle of attack."

It is obvious from the figure that (a) is only the angle between the chord line and the relative wind so long as there is no acceleration of air going on in front of the propeller disc, for otherwise the true "angle of attack" of the section under consideration is less than (a), due to the inflowing velocity ahead of the screw. It is the variations in the analysis caused by an inflowing axial velocity which made it necessary to employ correction factors, although were it possible to predict the amount of such an inflow, the necessity for such empiricism would probably largely cease to exist. The necessary modification in the analysis to take account of the added axial velocity ahead of the actuator is quite a simple matter, and the trouble is that the amount of such axial velocity is not known. We will therefore start by investigating the geometrical relations which exist between the various component forces assumed to be acting upon an element of an airscrew blade, and for this purpose we will introduce a modification into the preceding statement of the general analysis by considering the effect of the addition of an axial velocity (V_1) ahead of the screw disc. Fig. 1 will now become modified as in Fig. 2, and the geometrical statement of the problem is then as follows:

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*A paper read before the Aeronautical Society of Great Britain on March 21st, 1917.

†"The Screw Propeller," by F. W. Lanchester. April, 1915, I.A.E.

‡"Airscrews," by M. A. S. Riach.

Let Fig. 2 represent a section in plan and elevation of an airscrew blade cut by two concentric radii of (x) and ($x + dx$) respectively.

Let the angle made by the chord of the section with the direction of rotation, or disc of revolution, be denoted by (ϕ).

Let the airscrew have an axial velocity of (V) and a revolution speed or (n), so that the axial advance per revolution is (V/n).

Let there be an added axial velocity of inflow (V_1) immediately ahead of the actuator disc.

Let the angle of the effective helix be (A) and denote as before the angle ($\phi - A$) by (a) so that (a) represents the "angle of attack" of the section when (V_1) is equal to zero. But generally when (V_1) is not zero the real "angle of attack" is not (a) but (a_1) as in the figure, and then, for all positive values of (V_1), (a_1) is less than (a), and we may then denote the angle between the disc of revolution and the relative wind by (A_1). We then have at once the obvious relations:

$$\phi = A + a = A_1 + a_1$$

$$\text{and } \therefore A_1 = A + a - a_1 = \phi - a_1,$$

and let (b) denote the width of the section at radius (x). Then we are in a position to at once write down the forces acting upon the element from a consideration of the geometry of the figure.

Let Fig. 3 represent the forces acting upon the section at radius (x).

(L_1) denotes the lift of the section considered as an aerofoil.
(D_1) ,, drag ,, ,, ,, ,,

Then the resolved parts of (L_1) and (D_1) in an axial direction are :—

$$L_1 \,.\, \cos A_1 - D_1 \,.\, \sin A_1$$

and the resolved parts of these two forces in a transverse direction parallel to the disc of revolution are

$$L_1 \,.\, \sin A_1 + D_1 \,.\, \cos A_1$$

The first component represents the thrust of the blade element, and the second component represents the torque of the element divided by the radius. We then have the two following equations for the thrust and torque of the blade element. Writing (dT_1) for the thrust, and (dM_1) for the torque we have

$$dT_1 = L_1 \quad \cos A_1 - D_1 \,.\, \sin A_1$$

$$dM_1 = x \,.\, (L_1 \,.\, \sin A_1 + D_1 \,.\, \cos A_1)$$

and the efficiency of the element is given by

$$\rho = \frac{dT_1 \,.\, V}{dM_1 \,.\, 2.\pi.n} = \frac{\tan A}{\tan\,(A_1 + \gamma_1)}$$

where

$$\tan \gamma_1 = \frac{D_1}{L_1}$$

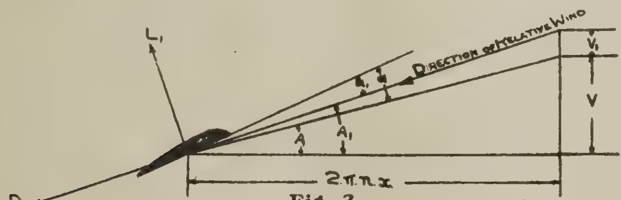

Fig. 3.

Now returning to the thrust and torque equations we see that since (L_1) denotes the elementary lift on the blade at a radius of (x), we may write

$$L_1 = cy_1.\rho.b.dx.v^2$$

$$= cy_1.\rho.b.dx \quad (2.\pi.n.x)^2 \,.\, \sec^2 A_1$$

$$\text{since } v = 2.\pi.n.x.\ \sec A_1$$

Where

(cy_1) denotes the absolute lift coefficient of the section at radius (x).

ρ denotes the mass/density of the fluid.

(b) denotes the blade width of the section at radius (x).

So that for the thrust of the element we have

$$dT_1 = cy_1.\rho.b.dx.4.\pi^2.n^2.x^2.\ \sec A_1.\ [1 - \tan A_1.\ \tan \gamma_1]$$

So that, denoting by (r_0) and (r) the inside and outside blade limits, usually taken to be the boss and tip, we get by integration :—

$$T_1 = 4.\pi^2.n^2.\rho.\int_{r_0}^{r} cy_1.b.x^2.\ \sec.\ A_1.\ [1 - \tan A_1 \,.\, \tan \gamma_1] \,.\, dx$$

giving the total thrust on each blade of the airscrew under the conditions imposed by an axial velocity of inflow.

And similarly for the total torque on each blade of an airscrew we have

$$dM_1 = \rho.b.cy_1.dx.x^3.4.\pi^2.n^2.\ \sec A_1.\ (\tan A_1 + \tan \gamma_1)$$

and therefore the total torque on each blade is given by

$$M_1 = 4.\pi^2.n^2.\rho.\int_{r_0}^{r} cy_1.b.x^3.\ \sec A_1.\ (\tan A_1 + \tan \gamma_1) \,.\, dx$$

and hence the brake horse-power (H) necessary to turn the airscrew is given by, denoting by (N) the number of blades,

$$H = \frac{N.8.\pi^3.n^3.\rho.\int_{r_0}^{r} cy_1.b.x^3.\ \sec.\ A_1.\ (\tan A_1 + \tan \gamma_1) \,.\, dx}{550}$$

in lb., foot, second, units and where (ρ) has the value of (·00238).

The total efficiency of the whole blade is obtained as follows, from the ratio-total useful work done per second to total work put in per second.

$$\eta_1 = \frac{V.\int_{r_0}^{r} cy_1.b.x^2.\ \sec A_1.\ (1 - \tan A_1.\ \tan \gamma_1) \,.\, dx}{2.\pi.n.\int_{r_0}^{r} cy_1.b.x^3.\ \sec.\ A_1.\ (\tan A_1 + \tan \gamma_1) \,.\, dx}$$

Now none of these formulæ can be applied unless the value of (V_1) for every radius (x) is known, so that (A_1) and its functions are also known. This brief summary of the geometrical analysis forms what may be termed the blade element aerofoil portion of the theory as enunciated in this paper, and is by way of being a mathematical tool for the investigation of problems of this nature, provided that the required values of the inflow velocity at each radius are known.

(To be continued.)

A Thousand Miles in Ten Hours

(Editorial in New York *Times*)

War continues to bring out new possibilities residing in that marvelous American invention, the aeroplane. To write more accurately, it continues to increase the possibilities already known to be possessed by that machine. As reported yesterday, Captain Giulio Laureami, an aviator in the Italian Army, made this week a continuous flight from Turin to Naples and back to Turin again. Precisely how long his journey was cannot be known, but it must have been more than 920 miles, which is the distance he would have traversed had he gone in a straight line both ways. The time used in making the journey was 10 hours 33 minutes, and the speed therefore can safely be put at about 100 miles an hour, and probably it was something more.

The achievement earns equal credit for the aviator and for his engine, for the wear and strain on both were such as could be met only by a close approach to perfection. It is not to be believed that such exploits will cease with the end of the war. Peace, too, has its needs for rapid transportation of passengers and mail—not such desperate needs as those of war, indeed, but sufficiently pressing to make it worth while to pay well for them.

An aviator able to carry 1,000 pounds of dead weight besides the live weight of himself—and that is within the present limit of capacity for aeroplanes—would have no difficulty getting a full load several times a week, if not every day, of letters for the carrying of which between New York and Chicago, for instance, postage of 10 cents an ounce would not be considered too much, if the letters were delivered within ten hours of departure from one or the other city. That would pay the incidental expense of man and machine, and leave a good profit besides.

We do not feel much need for such a service—we get along well enough without it—but that proves no more than did our like freedom from a sense of want before the telephone came into existence and use. Now, life without a telephone would seem next to impossible for no small part of the American population, and certainly we should miss it enormously and cruelly if it were taken from us.

Win the War in the Air

From the Jacksonville (Fla.) Metropolis.

A hundred thousand aeroplanes would accomplish more than four million men, is the belief of A. R. Hawley, president of the Aero Club of America. In appearing before the House sub-Committee on Military Affairs he suggested the expenditure of $1,000,000,000 for the building of airplanes to do service in the war zone. He confidently thinks that 25,000 aviators are worth more than a million men in arms, and he proposes that the United States center its activity largely on the furnishing of air machines and fliers for use in the various battle zones.

There is no doubt much truth in what Mr. Hawley has to say. Engines of destruction in large numbers in the air can do more to terrorize and disrupt the enemy than many a furious artillery bombardment. This should be one of America's chief aims. Both England and France are turning out about 4,000 machines monthly, but they find even this output insufficient. The efficiency of the aircraft in offensive warfare is recognized by both governments, but they are not in position to turn out more machines than they are at present doing. It is up to America to do it. Who knows but that it will not be finally the aeroplane and not the submarine which will win the war. It is possible.

FORMATION FLYING AS TAUGHT BY NATURE

By F. W. LANCHESTER*

IT has long been observed that certain birds—notably, wild geese, wild ducks, also swans, flamingoes, and pelicans—make a practice of flying *in formation*, there being a definite pattern of arrangement in which each bird keeps station. Akin to this in the matter of observation is the fact that certain other birds, such as starlings, may be seen to fly in a bunch, or swarm. Partridges likewise have their own manner of collective flight, and the term "like a covey of partridges" has become a matter of common expression.

It is only to the first, however, of these groups that the term "formation flying" strictly applies. When wild geese fly in formation the *pattern* adopted is almost invariably that of the letter V (Fig. 1), in which the bird at the apex, common to the two limbs, is the leader. The same formation may be seen also in the flight of wild ducks, but as often as not one of the limbs of the V is absent (Fig. 2).

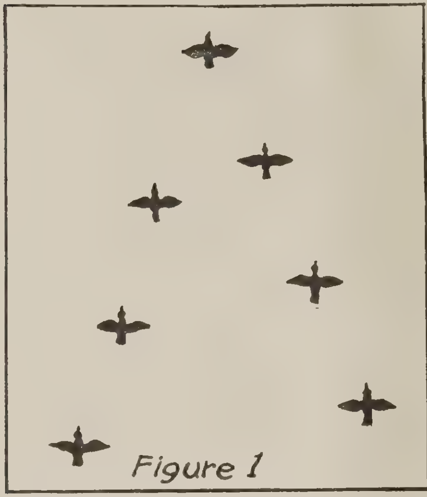
Figure 1

In view of the practice which has become general in military aeronautics in the course of the last eighteen months of flying in formation, the habits of birds in this respect have acquired a new interest. In the present article I propose to show that advantages exist in formation flying from an aerodynamic standpoint—that is to say from the point of view of economy of effort—which will justify us in regarding formation flying amongst birds as based on the same considerations as those which have led many animals, such as the mole, to prepare and travel along beaten tracks, and have led man to make roads and railways, the common object in every case being to lighten the burden of locomotion or transport.

It has already been remarked that it is not every case of collective or aggregate flying that can be classed as formation flying; in some cases, as in the example of the starling, there is no reason to believe that there is any saving in work done by the agglomeration or massing of the birds in flight. It is at times extraordinary the closeness of flying and density of these agglomerations; in the case of starlings the mass of birds in flight will sometimes cast a shadow almost as dense as that of a solid. There can scarcely be a question under these conditions of increased economy; in fact, from a theoretical standpoint the contrary is probably true; furthermore, there is indirect evidence that the theoretical view in this respect is correct. It has been suggested in these cases that the aggregation is a measure of defence against a common enemy. Whether this is so or not must be considered an open question—I have not myself had the opportunity or good fortune to make any critical observation on the subject.

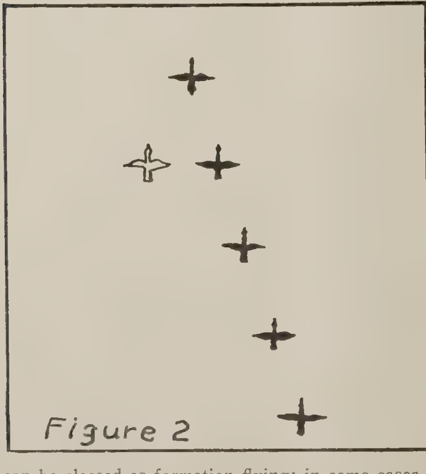
Figure 2

To revert to formation flying proper, as practised by wild geese, ducks, etc. Before the hidden meaning of the V formation can be appreciated it is necessary to enter into a brief discussion of the physical facts concerning sustentation in flight.

If we imagine that we are looking at a bird approaching us in gliding flight, as in Fig. 3, we know that the weight of the bird is distributed over the wing span, and that this distributed force brought to bear on the air immediately above and beneath the wing ultimately leaves in the wake of the bird in flight a vortex motion, which takes the form of what is known in hydrodynamics as a vortex pair, in which the movement of the air is of the character depicted in Fig. 3; immediately to the rear of the bird the direction is downward. We are all acquainted with vortex motion in some shape or form. One familiar example is the smoke ring which many a smoker will blow from his mouth; similar rings are often produced on a large scale by the firing of naval ordnance. The type of motion in a section through a vortex ring is similar to that depicted in Fig. 3.

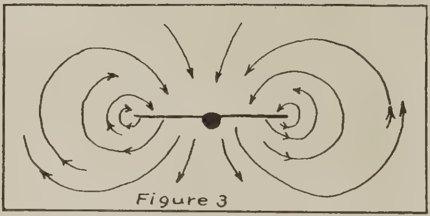
Figure 3

For demonstrating the properties of vortex rings the apparatus required is of the simplest possible description. A box (Fig. 4), say 10 in. square, has a hole cut about 3 in. or 3½ in. diameter in the centre of its bottom. A piece of canvas or other suitable fabric is nailed to the edge of the box in place of the lid. A blow delivered by the fist on this canvas cover generates a vortex ring sufficiently powerful to blow a candle out at 15 feet distance. The sizes given are suitable for demonstration in an ordinary room. This contrivance is familiar to most students who have attended lectures at a scientific or engineering college. In order to render the vortex rings visible the box is charged with smoke, but the generation of the rings takes place just the same, whether they are thus rendered visible or not.

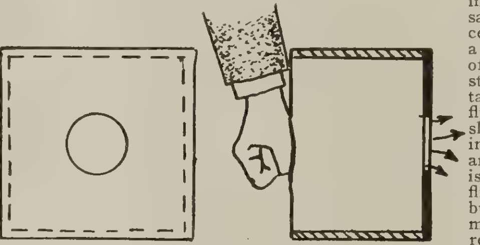
Figure 4

It is not infrequent that vortices are to be seen in windy and dusty weather on the ordinary high road. Buildings, trees, or some other obstruction will set up an eddy which persists for a considerable distance, sometimes miles, and the "cores" of the vortices so produced (for an eddy consists of vortex motion) are rendered visible, as in the ordinary smoke ring, but by the taking up of dust in place of smoke. Frequently also pieces of paper and other light objects are seen whirling around the central column in circulatory orbits. It is important to remember that whether it be a smoke ring or a water-spout, or a dust column, the portion of the vortical system visible is only the central core; the whole of the air in the vicinity is in a state of circulation as depicted in Fig. 3, to which reference has already been made.

The question of vortex motion has been investigated by mathematicians; the motion of a real vortex only differs from that of mathematical theory in what may be fairly considered as unimportant respects. Theory has shown that whether it be to initiate a vortex ring or a vortex pair, a force has to be exerted in the direction of the motion of the central region of the vortex. Actually, in the case of the vortex ring, whether produced from the mouth of a smoker or by other means, the applied force is the impulse given by the sudden ejection of air from the orifice. In the case of the vortex pair, which is the basis of sustentation in flight in Fig. 3, the applied force is the weight of the bird transmitted to the air by the wing spread. Thus from the present point of view sustentation in flight is definitely the utilisation of the weight of the bird to set up vortex motion in the air through which it travels—in detail, to give rise to a vortex pair having downward motion.

The peculiarity of the vortex generation by an aeroplane, or by a bird in gliding flight, is that the process is continuous instead of being intermittent.

When the bird is in active flight the gliding condition is varied, and undoubtedly each stroke of the wing gives rise to a downward vortex of the character of a vortex ring, so that instead of the continuous action on the air and the development of a vortex pair as in Fig. 4, we have the sustentation intermittent, and a number of vortex rings produced. It is probable, however, that even with a bird in active flight there is in addition to the intermittent reaction a certain degree of continuous sustentation, and the two systems, the continous and the intermittent, may be regarded as superposed. In either case, however, the essential fact is unaltered:—there is the generation of a vortex system characterised by a downward motion in the track of the bird in flight, and upward motion to the right and left, so that Fig. 4 may still be taken as typical.

The advantage of formation flying with birds and the *rationale* of the V formation becomes at once apparent. If birds were to proceed like battleships in line ahead, each one would be endeavouring to derive support from the air trodden by its predecessor, and one vortex system would be superposed on another having like motion. The result of this would be, as a matter of dynamics, that two birds would spend four times as much power in susetentation as one, and as the conditions of flight of the leader would be very little affected, the deficiency would have to be made good by the follower, and its expenditure of power, so far as sustentation is concerned, would be three times the normal. Knowing the skill shown by birds in avoiding unnecessary loss of power in flight, it may be taken as certain that if a bird were to find itself in such a position it would be very quick to get out of it. If, on the other hand, the follower, instead of taking up position in "line ahead," takes its position *en échelon*, it will find itself flying in the exterior region of the vortex, as shown in Fig. 5, and in this position it is being partially supported by the up current region, and the power necessary to sustentation in flight is accordingly reduced. Thus the conditions of flight of the leader remain normal, or nearly so, but the birds following find their labor in flying materially reduced. In my opinion it is for this reason, as stated by many observers, that the leader will retire and another bird take its place, and so the power expended, or work done, by members of the group is ultimately equalized.

If we take a flight of three birds in V formation in frontal presentation, as in Fig. 5, we see that the load of three birds is now distributed over a span approximately three times the span of the individual load, and broadly we may now regard this triple span as defining the interior as if the air disturbance had been created by a large bird spreading its wings over the total span involved. Thus any greater number of birds taking their places in the formation will in turn select the regions to the right and left hand of those which precede them, and so the V formation continues to include whatever number of birds are flying in concourse as already depicted in Fig. 1.

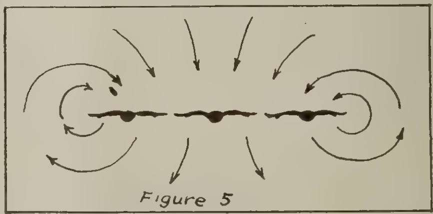
Figure 5

From a theoretical point of view it would probably be more economical still and would certainly put the birds on a more uniform footing, if they could fly wing to wing as in plan shown in region of the total vortex system; that is to say, in the motion ultimately left in the air the whole of the air within the compass of the triple span will be in downward motion, and the air outside this will be in upward motion, much Fig. 6, but clearly any attempt at adopting a "line abreast" formation of this kind would result in fouling and injury. In flying, whether of man or bird, it is always necessary to leave plenty of elbow room.

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* From *Flying* (London).

But the suggestion in the preceding paragraph leads to a different and equally instructive view of the problem. It is well known to every student of aeronautics that a considerable economy can be gained by the employment of what is known as *high-aspect ratio*—that is to say, a span that is great in proportion to the chord. To avoid troubling with definitions, Fig. 7 is a wing spread of low aspect ratio, and Fig. 8 (the albatross) is a wing spread of high aspect ratio. Now if a number of birds were to be in gliding flight, with the tips of their wings virtually in contact as in Fig. 6, the agglomeration might be regarded as a single bird of very high-aspect ratio, and as the total weight is being distributed over the same air base or total span when the birds are *en échelon*, we may take it that the *échelon* formation in Fig. 9*a* is equivalent, or at least comparable in respect of its system of sustentation to a single system of high-aspect ratio, as in Fig. 9*b*, and so we may regard the saving in power expenditure (so far as sustentation is concerned) as being equivalent to that of increasing aspect ratio of six, as represented in the figure, to an aspect ratio of thirty, where five birds or aeroplanes are in question. Thus from either point of view the lesson to learn from the style of the V formation is that it results in a diminution in the power necessary to flight.

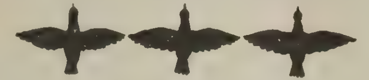
Figure 6

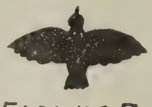
Figure 7

In endeavoring to form a quantitive estimate of the saving in question it is necessary to assess the mean upward velocity of the air in which the birds on either flank are operating. In the case of a system of three birds in V formation it would appear that those on either flank may be able to effect a saving of possibly as much as 75 per cent. or 80 per cent. of the power exerted by a single bird in flight, or we may say the leader of the formation. This estimate may be, and probably is, excessive, but my personal view is that the saving may easily be as much as 50 per cent., which would mean that so far as sustentation is concerned three birds or aeroplanes in formation do not require *for their sustentation* more power than two flying independently.

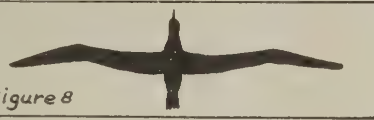
Figure 8

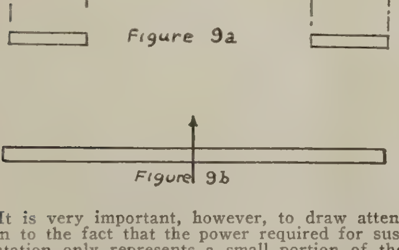
Figure 9a

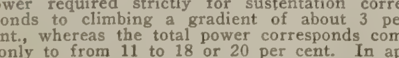
Figure 9b

It is very important, however, to draw attention to the fact that the power required for sustentation only represents a small portion of the total horsepower expenditure. So far as I am able to calculate or estimate the proportion, the position may be expressed by saying that the power required strictly for sustentation corresponds to climbing a gradient of about 3 per cent., whereas the total power corresponds commonly to from 11 to 18 or 20 per cent. In applying the foregoing facts to the problem of aeroplane flying in formation, the conclusion I have reached is that if we express the power required for a single aeroplane as 100, and that for three flying independently consequently as 300, the power required for the three flying in formation will be about 275, the saving being possibly as much as 10 per cent.

In the case of birds in active flight in V formation, it is most likely that the distance between the leader and the next follower in the direction of flight is determined by the speed of the wing motion and the speed of flight, these two factors determining the distance between the different wing beats. It seems more than a probability that there will be an advantage in arranging the wing beats of each bird and the one next following so that, should the span overlap, new air will be broken, the principle here involved being precisely that on which the V formation itself is founded.

It is not easy to explain many of the minor peculiarities and differences of flight of various species, and any attempt at explanation could at present only be on the most slender foundation. It is a simple fact, when the V formation is adopted by birds flying in concourse, that the two limbs of the V are by no means always equal, but it is curious that whereas in the case of wild geese observers agree in stating that the two limbs of the V are usually some semblance of equality, in the case of wild ducks this is by no means universally the case; in fact, qualified observers have stated that more often than not one of the limbs of the V is entirely missing. Attempts have been made to explain peculiarities of this sort on the basis of direction of wind, etc., but such attempts are too often based on confused and ill-founded notions of the principles of relative motion.

The manner of flight of the starling, already referred to, cannot be accounted for on an economic basis, as is the case where the birds adopt the V formation. So far as one is able to judge by ordinary observation the plan of flight is an irregular agglomeration rather than a formation; a space roughly spherical, about four feet in diameter, appears to be packed with birds flying as closely as possible without actual contact. Mouillard, who was an observer of undoubted accuracy, refers to a hundred birds occupying a space of two metres cube. Assuming the formation to be that described, it is clear that instead of a well-arranged system of flight, in which each bird deliberately selects a region of up current created by those in advance, we have almost the opposite, a large number of the birds treading the air which has already been trodden, and under these circumstances we should expect that the horsepower required for sustentation would be greater than if the birds were flying singly. If this deduction were correct the conditions correspond to those of a bird with more heavily loaded wing area, and the theory of least resistance indicates that birds thus flying in an aggregation should fly faster than when flying singly. If is of interest to note that Mouillard refers to the fact that starlings thus grouped fly with surprising velocity. He says: "L'étourneau isolé ne presente jamais cette vitesse."*

It might be thought from the foregoing that the object with which starlings group and fly in formation is in order to fly faster. But this would be a fallacy, for although to fly under the conditions of least resistance they need to travel faster, this is consequent on an increased resistance on lower velocities, and not the reverse. Mouillard again probably gives the correct explanation when he says, on the page already cited, that: "Cette Manière de se grouper est leur ordre de bataille pour rèsister à l'attaque du faucon. Leur ennemi plonge et replonge dans cette boule, mais la légion s'écarte, le laisse passer et se referme, et ce n'est que rarement que le vorace réussit dans sons attaque."†

The fact as stated as a matter of observation may be taken to be correct, but confessedly it is not clear as to why a hawk or falcon should find a greater difficulty in seizing one out of many starlings than to take a bird traveling singly. It seems more probable that the danger of injury in making an attack on a mob of birds travelling at unusually high velocity may be the real deterrent, beyond which, as birds of prey usually hunt singly and can only take one at a time, undoubtedly in effect flying in a mob or aggregation must result in diminishing the net "casualty list."

In conclusion, it is thus interesting to note that the practice of formation flying, as practised by birds, anticipates the practice of formation flying by man, both on the score of power expenditure, as in the V formation, and on the score of self-defence, or military necessity, as exemplified in the massed formation, of which the flight of the starling is given as an example.

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*"L'Empire de l'Air" (*Masson, Paris*), p. 100.

† "This fashion of grouping themselves is their order of battle for the purpose of resisting the attack of the falcon. Their enemy plunges and replunges into this mass, but the legion opens out, lets it pass, and reforms, and it is rarely that the bird of prey succeeds in his attack."

Urgent Needs of the Ordnance Department of the Army

The need of the Government in certain positions in the Ordnance Department of the Army is so urgent that we have been requested to publish the following official notice:

"The United States Civil Service Commission announces the following open competitive examinations for positions in the several ordnance establishments of the War Department or in or under the office of the Chief of Ordnance, War Department, Washington, D. C. The salaries named are for entrance.

Mechanical engineer, artillery ammunition, $3,000 to $3,600 year.

Mechanical engineer, experimental work, $2,500 to $3,000 year.

Mechanical draftsman, $1,000 to $1,400 year.

Apprentice draftsman, $480 year.

Inspector of artillery ammunition, $1,500 to $2,400 year.

Inspector of field artillery ammunition steel, $1,500 to $2,400 year.

Assistant inspector of field artillery ammunition steel, $3.50 to $5 day.

Inspector of ammunition packing boxes, $3.52 day to $1,800 year.

Inspector and assistant inspector of powder and explosives, $1,400 to $2,400 year.

Inspector of ordnance equipment, $1,500 to $2,400 year.

Assistant inspector of cloth equipment, $80 to $125 month.

Assistant inspector of leather, $100 to $125 month.

Assistant inspector of small hardware, $80 to $125 month.

Assistant inspector of textiles, $80 to $125 month.

Assistant inspector of leather equipment, $100 to $125 month.

Clerk qualified in business administration, $1,200 to $1,500 year.

Index and catalogue clerk, $1,000 to $1,200 year.

The examination for index and catalogue clerk is open to both men and women; the other examinations are open only to men.

The Governmently urgently needs men for the work above indicated, and qualified persons are urged, as a patriotic duty, to apply for examination. Until further notice applications for the positions named will be received at any time by the United States Civil Service Commission, Washington, D. C. Papers will be rated promptly. Applicants will not be required to appear at any place for examination, but will be rated principally upon the elements of education, training, and experience, as shown by their applications and by corroborative evidence.

Full information concerning examinations, application blanks, etc., may be obtained by calling in person upon the secretary of the local board of civil service examiners at the post office in any city in which city delivery of mail has been established, or by communicating with the United States Civil Service Commission, Washington, D. C.

(*Continued from page* 965)

cal Reserve Corps, to active duty at the Georgia School of Technology at Atlanta, Ga., as a member of the examining board, Aviation Section, Signal Officers' Reserve Corps, from July 21, 1917, is confirmed and approved.

1st Lt. A. W. Betts, Av. Sec., to Ft. Sam Houston.

1st Lt. E. Behrendt, Av. Sec., to Belleville, and report to commanding officer.

1st Lt. J. A. Richards, Av. Sec., to Mt. Clemens, report to commanding officer.

1st Lt. W. H. Murphy, Av. Sec., to Ft. Sam Houston.

1st Lt. S. A. Blair, Av. Sec., to Ft. Sill.

1st Lt. R. Benson, Av. Sec., to Fairfield Av. Sec.

1st Lt. W. W. King, Av. Sec., to Wilbur Wright Field.

1st Lt. G. L. Richter to Ayer, Mass., and report to Commanding General, Northeastern Dept., for duty as signal supply officer, Camp Devens.

Following officers, Av. Sec., participated in aerial flights on dates specified.

First Lieutenants

Connell, C. W., July 3.
Richmond, A. L., July 17.
Este, J. D., July 25.
Sellers, C. G., July 25.
Harvey, F. H., July 17.

Signal Reserve Corps

1st Lt. W. A. Boggs, Jr., Av. Sec., to Ft. Sill.

1st Lt. H. D. Lindsley, Jr., Av. Sec., to Fairfield.

1st Lt. L. L. McGrady, Av. Sec., to Boston.

Capt. F. H. Maguire, Av. Sec., to Ft. Sam Houston.

1st Lt. D. H. Young, required to participate in flights.

1st Lts. J. W. Ramsay and L. Theo. Belmont, Av. Sec., will report to commanding officer, School of Military Aeronautics, University of Texas.

TESTING VARIABLE-SPEED ENGINES BY A NEW METHOD

By Prof. DANIEL ROESCH

Associate Professor of Gas Engineering, Armour Institute of Technology

THE present method of testing variable speed gas engines, as used in automobiles, motorcycles, marine craft or aircraft, consists primarily of determining the maximum torque and horsepower at a number of different speeds. These results are plotted on coordinate paper; a smooth curve drawn through them represents the ultimate torque and horsepower characteristics for all speeds within the test range. The gasoline consumption is often taken simultaneously with these data. The gasoline consumption per hour or per brake horsepower per hour can then be plotted in the same way. These data are customarily taken under wide-open throttle conditions, the results being plotted with revolutions per minute as abscissas and the other variables as ordinates. These data and others less frequently taken during tests or derived from test results are:

(1) Revolutions per minute of the engine.
(2) Developed torque—average turning-moment developed.
(3) Brake horsepower—calculated from (1) and (2).
(4) Friction torque.
(5) Friction horsepower.
(6) Gasoline rate—preferably weight per unit of time.
(7) Gasoline economy—weight per unit of time, calculated from (6) and (3).
(8) Jacket-water rate—preferably weight per unit of time.
(9) Sensible heat in exhaust—by calorimeter.
(10) Exhaust analysis—for incomplete combustion.
(11) Radiation—preferably obtained by difference.
(12) Air rate—weight per unit of time.
(13) Mixture ratio—calculated from (6) and (12).
(14) Depression in inlet manifold—indicating carbureter resistance.
(15) Pressure in exhaust manifold—indicating exhaust-pipe resistance.
(16) Spark advance.
(17) Mean effective pressure, net—from (2), or (1) and (3).
(18) Mean effective pressure, actual—from indicator card; from (1), from (3) and (5), or from (2) and (4).
(19) Mechanical efficiency—from (2) and (4), from (3) and (5), or from (17) and (18).
(20) Compression pressure—by indicator test.
(21) Heat balance—percentage of heat supplied appearing as:
  (a) Indicated horsepower.
    1. Brake horsepower.
    2. Friction horsepower.
  (b) Jacket-water loss.
  (c) Sensible heat of the exhaust.
  (d) Incomplete combustion.
  (e) Radiation.

These characteristics of a variable-speed engine show only its performance under wide-open throttle conditions—a condition often not maintained in use. It would follow then that an engine **A**, showing superior merits to an engine **B** under the usual test conditions, can have inferior merits when tested under partly open throttle. This difference would have little moment where the engine operates largely at wide-open throttle, but might have a determining influence where the operation was chiefly at partly-open throttle, as in the automobile or motorcycle engine.

Preliminary Investigations

In order to investigate this question and develop a method of analysis for engines of this type the author suggested to Messrs. Cooban, Palmer and Stepnek, Class of 1915, Armour Institute of Technology, that they conduct a preliminary investigation of this problem as a thesis. This investigation furnished the necessary data upon which the method was developed. Additional investigations utilizing and developing this method of testing are at present being conducted in the Armour Institute laboratories by Messrs. Fritze, King and White, Class of 1917.

Electric-dynamometer tests were conducted on a high-class 4 by 5½-in. six-cylinder L-head engine built about June, 1914. The data were taken so as to cover all ranges of speed and load on the engine, whereas the customary method covers all ranges of speed at maximum load only. The engine was new, was fitted with stock pistons and had no extra provisions for lubrication. It was deemed therefore advisable not to operate at high speed or heavy loads more than ten minutes without decreasing the load. A run confined to this time limit gave accurate readings of power and economy with possibly questionable readings of jacket losses.

Since this paper deals with the method of obtaining new test data and not the actual figures obtainable, slight inaccuracies are of no particular consequence. The test data as replotted nevertheless represent performance characteristics in a new and broader way than heretofore observed. While the 1915 preliminary thesis established that such a method gave the desired information, it was considered more cumbersome than the one here described.

If data enumerated under items (1) to (21), inclusive, were taken during a test of an engine the resultant curves migh be conventionally shown as in Figs. 1 to 3, inclusive. It is to be again noted, however, that only wide-open throttle conditions of operation are represented by these curves.

Methods of Complete Analysis

The complete analysis of an engine of the type considered can be determined from data taken in the following manner:

Tests are first made in the conventional way at various speeds with wide-open throttle. Whatever data are desired are then taken at each test speed and the customary characteristic curves plotted. One of these will be the torque curve, which is frequently taken as the pull in pounds at a 15¾-in. radius. This characteristic is represented by **A**, Fig. 4. The corresponding horsepower curve is represented by *1*, Fig. 4, and shows the maximum power developed at any speed. If now a constant torque of, say, 140 lb. at 15¾-in. radius be maintained and the test conducted as before, we can obtain torque curbe **B**, Fig. 4, and the corresponding horsepower curve *2*. Similarly the curves **C, D, E** and **F**, and their respective horsepower curves *3, 4, 5* and *6* are obtained for various constant values of torque.

Whenever the torque line is horizontal a constant mean effective-pressure, net, has been maintained by the engine; also the horsepower increases directly with the speed. This is similar to the N. A. A. M. horsepower rating and its corresponding mean effective-pressure, net. These lines are added to Fig. 4 for comparison. Since the horsepower of all but the first series of tests is proportional to the speed these curves will be straight lines and pass though the intersection of the axes.

Instead of selecting constant even-value torques for lines **B, C, D, E** and **F**, an alternative method would be to obtain these curves so that they would correspond to 67.3 lb. m.e.p., net, and say 15, 30, 45, 60, 75 and 90 lb. m.e.p., net. The advantage would be in subjecting various engines to like net mean effective pressures for each series of tests. This would facilitate comparison of performances. The disadvantage lies in having an odd value for the torque, which may be confusing during testing.

While this analysis can be applied to all of the data enumerated at the beginning of this paper, the factors of fuel consumption, mechanical efficiency and spark advance are probably the most important. The method of determining these and other characteristics under all conditions of load and speed will be indicated.

Obtaining Contour Lines

The total fuel-consumption curves for conditions as indicated, curves **A, B, C, D, E** and **F**, Fig. 4, are shown by curves similarly marked in Fig. 5. The gasoline consumption in pounds per brake horsepower per hour for each load condition was also computed and plotted in Fig. 6. These curves then furnish the necessary data to establish the load and speed for any particular gasoline consumption. A set of interpolation curves was then constructed for 400, 600, 800, 1000, 1200, 1400, 1600 and 1800 r.p.m. with brake horsepower as abscissas and gasoline consumption in pounds per brake horsepower per hour as ordinates. The data for these curves were taken from the curves in Fig. 6. These interpolation curves furnished sufficient points for, say, 0.7 lb. per brake horsepower per hour, to locate properly this contour line in Fig. 7. The other lines of actual thermal efficiency were plotted in a similar manner from the same interpolation curves.

Line No.	1	2	3	4	5	6	7	8	9
Gasoline, lb per B. Hp. per hour	0.66	0.7	0.8	0.9	1.0	1.25	1.5	2.0	2.5
Thermal efficiency on B. Hp.	19.3	18.2	15.9	14.1	12.7	10.2	8.5	6.4	5.1

Lines of equal gasoline consumption were thus established from these test data, as shown in Fig. 7. Lines of equal spark advance, Fig. 8, have been determined in a similar manner. Lines of equal mechanical efficiency, Fig. 9, have been determined by the conventional electric dynamometer method. There appears to be no reason why any of the other test data ever taken could not be graphically shown in a similar manner.

Summary

The chief advantage of the data presented graphically in the manner indicated is that they show concisely and clearly the performance of the engine under every possible condition of load and speed. Academically the method has already been found valuable in disclosing completely the various engine characteristics. Commercially the determination of certain of the contour lines has been found valuable in design study of the engine features affecting them.

The gasoline-economy contour of various carburetors on the same engine should be of particular value for purposes of comparison. The same curves from different engines would be of value in more closely predicting car mileage per unit of fuel consumption.

The data on sensible heat in the exhaust should be of value in the design of kerosene carbureting devices, with which considerable heat is required for fuel and air preheating.

The jacket-water rate and loss should be of value in pump and radiator design.

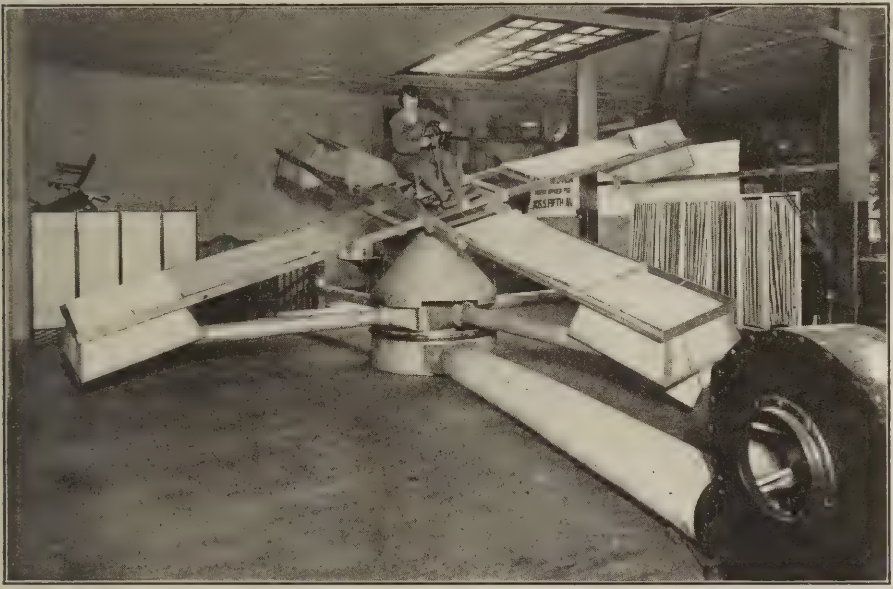
The spark-advance contour curves are valuable in design of automatic spark-advance mechanisms, which advance correctly the spark for load and speed variations.

Army Instructors at one of the training fields

AN APPARATUS FOR TRAINING AVIATORS

AMERICAN inventive ingenuity has found a way of speeding up the training of aviators. Considered scientifically, an aviator can move his aeroplane only in three dimensions, while flying—he can point it up or down, or prevent it from pointing up or down, which is one; he can tilt it to the right or left, or prevent it from so tilting, which is two; and he can turn it to the right or left or prevent it from turning, which is three and the limit of his control. From the combinations of these three movements, together with the forces of the motor and gravity, flying, with more or less proficient results.

The Teratuter, as the apparatus is designated, was developed from the notion that if a man could be drilled to produce those identical movements with the identical control wheels and levers that are used on an actual aeroplane, to the point where he could do it instinctively with the precision and speed of the accomplished aviator, and the drilling done on a dummy aeroplane mounted to go through a full range of the aeroplane's movements, much flying practice would be gained.


The "Teratuter," which teaches aeroplane control

Aside from the field value of the Teratuter, it can be erected in college buildings to accompany the theoretical training of those who are to become officers in aviatoin corps. The one in the illustration—the first one invented—is an acessory of a flying institution. The occupant is a local moving picture star who is so enthusiastic about its operation that she has spent more hours in it than is strictly needed.

To make the device as realistic as possible, it is operated by a great volume of compressed air. The inventor, himself an aviator, has adjusted the aeroplane members which produce or correct the Teratuter's motion to be about equal to the movements of a real aeroplane flying in a 40 miles per hour wind.

(*Continued from page* 960)

Congressman Hulbert Praises National Special Aid Society's Good Work

Congressman Hulbert delivered a rousing address praising the efforts which the National Special Aid Society has been marking on behalf of aerial preparedness and to make the lot of our aviators pleasanter. He told of the aviators' present needs which are not met by the government and urged those present to support the good work of the National Aid Society.

Hy Mayer, the well known cartoonist started the fun going with his cartoons and John Hazzard, with his stories, imitating various foreigners and giving a touch to them that kept the audence constantly laughing and applauding. Mr. Mayer was one of the big hits of the evening with his cartoons of every description, notably of Uncle Sam and the war.

Madame Del Valle, wonderful of voice and charming of appearance, sang "The Star Spangled Banner" beautifully and received an ovation at its conclusion. She responded with the new song by Mrs. May Hartman, "If the World Should End Tomorrow." She was recalled to sing it again. This song will become immensely popular.

Miss Elsie Janis, who some years ago made the hit of her career at that time in Newport, came forth and instantly the house was applauding. Her first number, a song of the Janisism sort, "Preparedness," was about a convalescent soldier and a nurse. It was a great song and the manner in which Miss Janis rendered it swayed the audience as she did soon again with the song, "The H'allies H'owes Much To H'us," a Cockney woman being imitated in the rendition.

For a great big encore Miss Janis imitated herself in singing "It's Your Country and My Country," followed by the way George Cohan, Miss Ethel Barrymore and Eddie Foy would sing the song. Miss Janis gave her dance and when the audience finally allowed her to rest, she brought to the stage Major McCutcheon, whom she presented.

When he was sole possessor of the stage he told a very amusing story of how the passengers upon the steamer he came back home on as an invalid prepared against submarine attack. He won a tremendous outburst of applause.

Miss Alma Belwin recited splendidly, "To France;" Mr. John Charles Thomas sang; Wate Leipsig, one of the best card manipulators ever showing here, was assisted by a committee consisting of Mr. Hawley, Mr. Craig Biddle, Jr., and several others. Mr. Scott Welch sang. So the entertainment was of a calibre which would have cost thousands of dollars to secure, if the professionals had not volunteered their services. Mr. J. Clarence Harvey, who was to have read original poems, was prevented from appearing by illness.

Fiske Says Nation Fights With Devil

"We are at war with the incarnated combination of intellect and evil; we are at war with the Devil himself," said Rear Admiral Bradley A. Fiske, U. S. N., in his address to the National Special Aid's big meeting at Newport, Rhode Island, the account of which appears elsewhere in this number.

Admiral Fiske said in part: "Major McCutcheon, a highly distinguished officer of the British army, will tell you of the work of the British airmen. Major Perfetti, a highly distinguished officer of the Royal Italian Flying Corps, will show you pictures of the most powerful aeroplanes that have been produced, and will explain to you how they can be used to assist the Allies' cause on both land and sea, and how they can be made to secure a decisive advantage for the *Allies, unless the enemy is quicker than we to take advantage of them or machines like them.* He will show you pictures of aeroplanes which could fly from England to Kiel or Wilhelmshaven, carrying the heaviest torpedoes, and attack the German fleet, or *which could fly from Germany to Great Britain and attack the British fleet.*

"These pictures are commended to your close attention, *and you are requested to realize the advantages which will accrue to the side which forestalls the other in utilizing machines here pictured.*

"The urgency of the situation in Europe and America demands that we utilize every advantage that we can secure and that we accept from aeronautics, in particular, because it is the newest art, every aid which aeronautics can bestow; for history warns us that *nothing tends more to defeat in war than an ultraconservative attitude toward new inventions.* We need the aid of every good invention that can be produced.

"We are at war with the most formidable nation in the world; the nation that has always made a specialty of preparing for war and waging war; the nation that for 277 years has bent all the energies of its individual members and of its organized Government to advancing its interests by war; the nation which more than any other nation has achieved a high standing before the world in philosophy, mathematics, physical sciences and music, but which has always held them lower than the military arts and sciences; a nation that has numbered many men, skilled in many peaceful arts, but *which has always subordinated them to men skilled in the warlike arts.* We are at war with the nation which prosecutes war with greater skill knowledge, cunning, foresight, determination, ruthlessness and perfidy than any other nation, past or present. *We are at war with the incarnated combination of intellect and evil; we are at war with the Devil himself.*"

THE MANUFACTURE OF STEEL FOR AIRCRAFT

An Elementary Study of the Processes Employed in the Production of Steel and the Characteristics and Uses of the Resulting Materials*

Introduction

SINCE steel contains a large proportion of iron with an admixture of other substances and may in a sense be considered as iron in a carbonized state, any account of steel-making would be incomplete without a preliminary description of the phases through which the iron passes before its conversion into steel.

Iron—In its natural state iron is found in the ground as an ore, and after being brought to the surface is roasted or "calcined" in large heaps like lime stone. It is then smelted with contents of the furnace have become liquefied which air is blown to remove the impurities in the ore—the iron itself being pure. When the contents of the furnace have become liquefied and fusion has taken place, the "cinder," or "slag," rises to the surface and flows out through a hole known as the "cinder notch." The iron is then allowed to flow out of the crucible, which forms the base of the furnace, through a hole previously plugged down a channel, known as the "sow," into a number of smaller side-channels, called "pigs," where it is allowed to cool. The resulting metal is known as pig-iron.

During this process the iron has absorbed certain impurities—silicon and phosphorus from the ore or lining of the furnace, and sulphur and carbon from the charcoal or coke in the furnace—and it is therefore necessary for it to pass through a refining process in a "puddling" or "reverberatory" furnace, where it is gradually worked by long-handled "rabbles," manipulated by hand, into large round balls—weighing from 3 to 5 cwt.—which are subsequently hammered or rolled into flat bars.

This bar iron is the raw material for steel. The better qualities are imported from Sweden and are almost entirely free from carbon—which has been absorbed by the oxygen in the puddling furnace. In the production of the best Swedish bar iron no coke is allowed to come in contact with the metal in any of the processes, all the heating being carried out by means of wood charcoal.

Steel—Owing to the wide variations in the composition of different classes of steel, and the thinness of the dividing line between iron and some of the lower tempers of mild steel, a satisfactory definition of steel is by no means easy to arrive at, but perhaps the best that can be adduced in that it is a material which is capable of being hardened and tempered.

The carbon content of steel varies from 0:25 per cent. to 1:40 per cent. Material containing a less quantity of carbon than 0:25 per cent. possesses the properties of bar iron, though it is sometimes designated mild steel if produced in a Bessemer, Siemens-Martin, or electric furnace.

There are four principal processes for the production of steel.

Production by the Crucible Process

In making crucible cast steel, the higher qualities of which are made from Swedish bar iron, the iron is first subjected to a "conversion" or "cementation" process, which consists in placing it between layers of charcoal in a furnace, heating it red hot, and keeping it so until the requisite degree of hardness is obtained through the absorption of carbon from the charcoal. It is then allowed to cool gradually before removing from the furnace, the whole operation lasting from three to four weeks. Great care is exercised in the selection of the raw material, which should have been smelted with wood charcoal (not coke, which has sometimes been used of recent years), as this keeps down the percentage of phosphorus and sulphur. The bar iron is thus converted into bar steel, which is generally known as blister steel from the blisters produced on the surface of the metal during conversion.

After leaving the converting furnace the blister steel goes to the melting furnace, where it is broken into small pieces, sorted into the various tempers, and weighed up with best tool "scrap," spiegel, ferro-manganese and other "physics" and alloys, together with a quantity of wood charcoal, which varies according to the degree of hardness required.

Sufficient of these ingredients is put on to a pan to provide a charge for a clay pot, or "crucible," in which the metal is melted in the furnace.

A melting furnace consists of six, twelve, or eighteen holes—each large enough to contain two pots—which are sunk in the ground, and six holes are worked by one set of men. A hole is heated by coke and the pots are put in and remain until the contents are molten and white hot, when the lid of the hole is removed and a pot withdrawn by the puller-out, a long pair of tongs being used for the purpose. The head melter then pours, or "teems," the contents into an ingot mould set up on end in a bed of sand. This is a highly skilled operation as the weight of a pot is from 56 lb. upwards, the heat is intense, a shower of sparks fly in all directions, and if the molten metal touches the side of the mould while being poured in, a flaw will be formed in the finished ingot. As the mould stands some four feet high and is only about two and a half inches square in section, the delicacy of the operation may be imagined.

While the melter is teeming an assistant stands by with a long "slagger" and prevents the scum on the top of the metal from going into the mould, much as the cream on the top of a milk jug might be kept back by a spoon. Both men wear sacking aprons and leggings saturated in water to prevent their clothes catching fire from the heat and sparks.

The process of teeming is known as a "round," and there are usually three rounds per day for each pot; the weight in a pot varying with each heat so as to lower the wash of the molten metal on the side of the crucible.

When crucible cast steel is intended for tools with a fine cutting edge—such as razors, surgical instruments, etc.—the iron is previously converted into blister steel, as described above, and the higher carbon necessary obtained with the addition of charcoal, but in the case of the cheaper qualities of tool steels, iron or steel scrap may be used and carbonization effected by using Swedish bar-iron in place of charcoal.

Crucible steel ingots weigh about 60 lb. each and are usually made in the following six tempers according to the percentage of carbon:—

No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
0:70%	0:80%	0:90%	1:0 %	1:20%	1:30%

The percentage of manganese varies from 0:25% to 0:40%.

When the ingots are cold they are "topped" by having about three inches knocked off, and they are then reared up on end and the tempers sorted out by the eyesight of the "master." It is not possible to have each ingot analyzed nor is it necessary in practice, as an expert can judge the carbon to within 0:1%. The harded tempers—higher carbons—show a fine sparkling grain which is quite distinct from the coarse "sappy" grain of the milder qualities.

No. 1 temper is used for hammers, stamping or pressing dies, miners' drills, etc., and will weld easily.

No. 2 temper is suitable for chisels, minting dies, large shear blades, smiths' tools, etc., and weld somewhat less easily than No. 1.

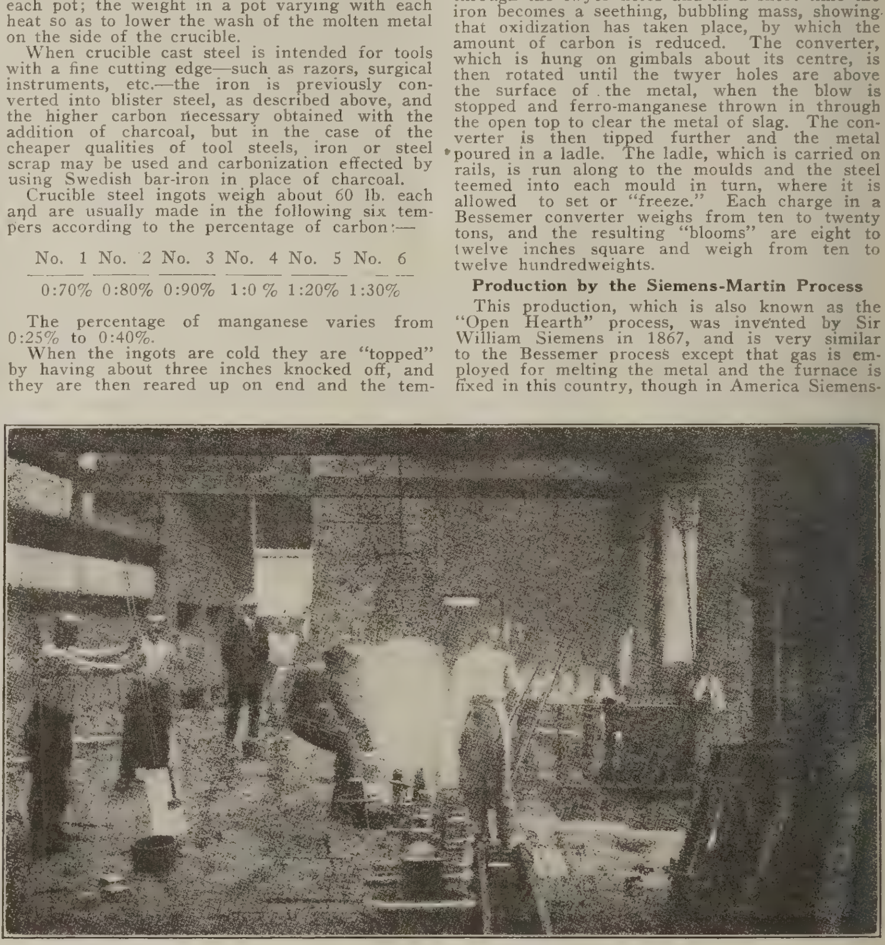
No. 3 temper is used for cold chisels, medium-sized shear blades, large punches and taps, etc. It requires care in welding.

No. 4 temper is used for drills, large turning tools, circular cutters, taps, rimers, small shear blades and small punches, etc. This quality can be welded if great care be exercised.

No. 5 temper is suitable for turning, planing and slotting tools, drills and small cutters. It will not weld.

No. 6 temper is suitable for turning and planing tools, drills, razors, surgical instruments and all tools requiring a fine cutting edge. It requires to be very skilfully worked and is easily spoilt by over-heating.

The crucible process is the oldest now in use, having been invented by Benjamin Huntsman, of Sheffield, in 1740, and produces the highest grades of steel.



IN A MELTING FURNACE

The head melter is teeming the contents of a crucible into an ingot mould, while an assistant keeps back the scum with a slagger. On the left a crucible has just been removed from the furnace ready for teeming, while in the foreground are some ingots setting in the moulds

Production by the Bessemer Process

The Bessemer converter was invented by Henry Bessemer in 1856 and consists of a large pear-shaped receptable open at the top and with holes at the side near the bottom, known as "twyer holes."

The raw material is pig-iron—as opposed to bar iron or blister steel in the crucible process—which is first melted and poured into the converter in a molten state. The hearth at the bottom of the furnace is heated with coke, and after the metal has been introduced air is blown through the twyer holes and in a short time the iron becomes a seething, bubbling mass, showing that oxidization has taken place, by which the amount of carbon is reduced. The converter, which is hung on gimbals about its centre, is then rotated until the twyer holes are above the surface of the metal, when the blow is stopped and ferro-manganese thrown in through the open top to clear the metal of slag. The converter is then tipped further and the metal poured in a ladle. The ladle, which is carried on rails, is run along to the moulds and the steel teemed into each mould in turn, where it is allowed to set or "freeze." Each charge in a Bessemer converter weighs from ten to twenty tons, and the resulting "blooms" are eight to twelve inches square and weigh from ten to twelve hundredweights.

Production by the Siemens-Martin Process

This production, which is also known as the "Open Hearth" process, was invented by Sir William Siemens in 1867, and is very similar to the Bessemer process except that gas is employed for melting the metal and the furnace is fixed in this country, though in America Siemens-Martin furnaces are sometimes made tiltable in the same way as a Bessemer converter to facilitate drawing off the metal. Pig-iron is again the raw material in conjunction with steel "scrap" and iron ore, which are put into the furnace in the cold state and heated without being brought into contact with any solid fuel.

At each end of the furnace are two chambers, called "regenerators," through which pass air and gas respectively on their way to the furnace, the products of combustion passing out the other side. The gas and air chambers are separated from each other by firebrick walls which are heated at the same time as the furnace.

When the furnace is hot and the metal has become molten, the gas and air are turned on and become heated by circulating in the hot brickwork until they reach the open furnace above the molten metal, when combustion takes place, after which the burnt gases pass out indiscriminately through the gas and air regenerators on the other side.

Periodically the direction of flow of the gas and air is reversed by means of valves, so that the regenerators on each side are alternately heated by the burnt gases and cooled by a fresh inflow of air and gas.

At one corner of the furnace is a long metal spout, the entrance to which is plugged with ganister and anthracite. When conversion has taken place this spout is "tapped" by breaking up the plug with a long iron rod and the metal flows out into a ladle, similar to that used with a Bessemer converter, from which it is poured into the bloom moulds.

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* From *Aeronautics* (London).

Both acid and basic steels are made in Bessemer converters and Siemens-Martin furnaces, the difference lying in the material used for lining the metal receptacle.

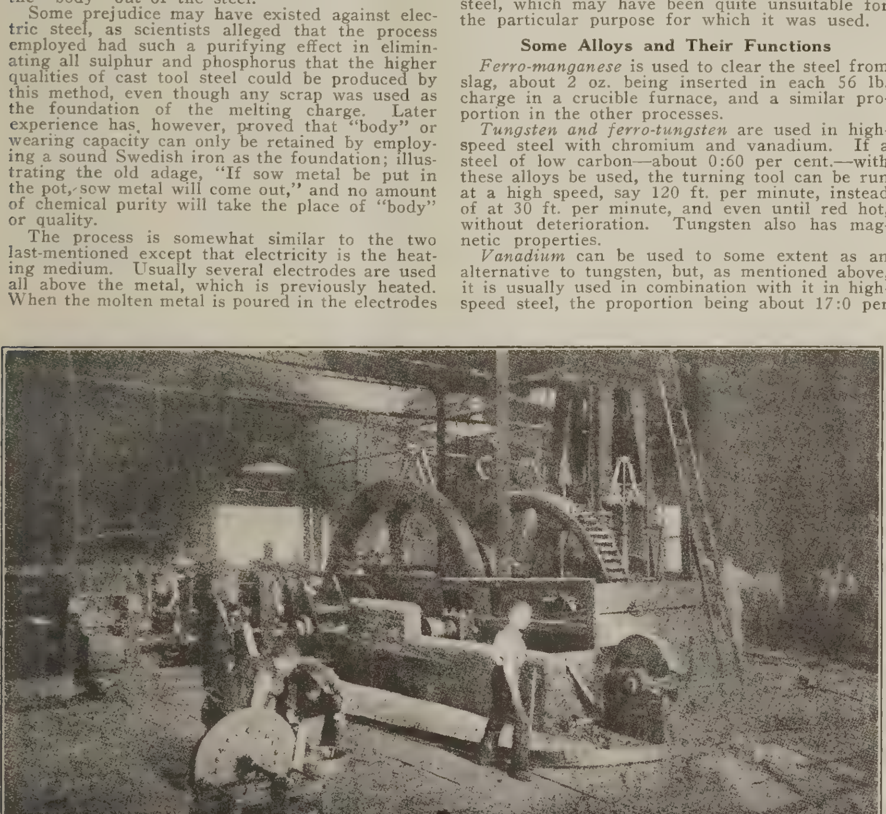
In the acid process, which is the more common, in a Bessemer converter the lining is composed of ganister or occasionally firebrick, and of silica brick in the Siemens-Martin furnace, whereas some basic material, such as dolomite, is used in both types of furnace in producing basic steel.

Production by the Electric Furnace

This is the most modern process, and before the present war was mainly used for purifying Bessemer or Siemens-Martin steel, the molten metal being passed from the furnace through an electric furnace on its way to the moulds, as by this means sounder castings were obtained. More recently, however, electric furnaces have been employed successfully for the production of high-speed steel, etc., though the intense heat generated appears to have the effect of taking the "body" out of the steel.

Some prejudice may have existed against electric steel, as scientists alleged that the process employed had such a purifying effect in eliminating all sulphur and phosphorus that the higher qualities of cast tool steel could be produced by this method, even though any scrap was used as the foundation of the melting charge. Later experience has, however, proved that "body" or wearing capacity can only be retained by employing a sound Swedish iron as the foundation; illustrating the old adage, "If sow metal be put in the pot, sow metal will come out," and no amount of chemical purity will take the place of "body" or quality.

The process is somewhat similar to the two last-mentioned except that electricity is the heating medium. Usually several electrodes are used all above the metal, which is previously heated. When the molten metal is poured in the electrodes are brought into momentary contact with the metal, and then separated from it, and an arc established between the two. In the case of small furnaces, where a large proportion of the heat is occupied in keeping hot the furnace itself, it is frequently found advisable to heat the hearth separately in order to get uniform heating throughout the bath.



A HOT-ROLLING MILL

This is particularly desirable in melting high-speed steel with a high percentage of tungsten, as this metal has a very high specific gravity and also a high melting point, and if the hearth were not heated the tungsten would sink to what would be the coldest part of the bath.

Electric furnaces are tilted and the metal poured off into a ladle after the method adopted with Bessemer converters.

Methods of Production Contrasted

The Bessemer and Siemens-Martin processes are closely allied and are chiefly used for melting English and Spanish pig-iron, with a small admixture of Swedish for the better qualities. The steel is of lower grade than crucible steel and is used for rails, mining steel, spring steel, black plates, etc.

Being cheaper and more rapid (of the two, Siemens steel usually commands a slightly higher price) they are used to melt cheaper materials than the slower and more expensive crucible process, which is primarily employed for melting the highest class materials from Swedish bar iron with a small proportion of best tool steel scrap.

When it is realized that Bessemer blooms are teemed, rolled down into rails, cut into lengths with a circular saw, and stacked for shipment without ever having become cold, and this is compared with the many processes through which best cast steel is put, the reason for the difference in cost becomes apparent.

It should be remembered by the toolsmith that a tool steel of 0:45 per cent. carbon made by either the English Bessemer or Siemens process is, for hardening purposes, comparable with a crucible steel of 0:70 per cent. carbon, while for welding, the same temper in crucible steel is similar to the Bessemer or Siemens 0:35 per cent. carbon. Swedish Bessemer approximates more closely to crucible in this respect.

The tempers of ordinary Bessemer and Siemens steels vary usually from 0:10 per cent. to 0:65 per cent. carbon and 0:60 per cent. to 0:80 per cent. manganese, as compared with the 0:70 per cent. to 1:30 per cent. carbon and 0:25 per cent. to 0:40 per cent. manganese of crucible. Special qualities of Siemens are now made containing up to 1:30 carbon for files, turning tools, steel for export, etc.

When ordering steel, therefore, it is essential for the specification to give the purpose for which it is required as well as the carbon, in order that the manufacturer may recommend the best steel for the purpose. Neglect of this precaution often leads to failure with consequent blaming of the steel, which may have been quite unsuitable for the particular purpose for which it was used.

Some Alloys and Their Functions

Ferro-manganese is used to clear the steel from slag, about 2 oz. being inserted in each 56 lb. charge in a crucible furnace, and a similar proportion in the other processes.

Tungsten and ferro-tungsten are used in high-speed steel with chromium and vanadium. If a steel of low carbon—about 0:60 per cent.—with these alloys be used, the turning tool can be run at a high speed, say 120 ft. per minute, instead of at 30 ft. per minute, and even until red hot, without deterioration. Tungsten also has magnetic properties.

Vanadium can be used to some extent as an alternative to tungsten, but, as mentioned above, it is usually used in combination with it in high-speed steel, the proportion being about 17:0 per cent. tungsten and 1:0 per cent. vanadium.

Nickel has a general toughening effect in the milder classes of tool steel, such as chipping chisels, dies, etc.

Chrome has a similar effect to nickel, and is also used in turning tools of a cheaper quality to replace tungsten, when the latter would be too expensive. In quantities of 14 per cent. and upwards it renders steel rustless and is therefore largely used in aircraft steels, as well as for rustless cutlery.

Chrome-nickel steels are largely used for armour plates and usually made in electric or Siemens-Martin furnaces.

Subsequent Processes

Annealing is carried out to render the steel easy to work in the lathe. The bars are heated red hot, usually in a gas furnace, soaked for four hours at a temperature of 750 deg. to 850 deg. (Centigrade) and then allowed to cool gradually in the furnace for two days. The furnace must be completely airtight, or scale will rise on the bars, and no air must be admitted or the bars drawn out until they are quite cold. Round bars for drills or taps are usually enclosed in an iron tube with the ends sealed up with cement to avoid any possibility of the fire getting to them and causing the scale to rise.

Hardening and tempering—After a tool has been formed to shape it is re-heated to a bright red and plunged into a bath of oil—if the steel is above 0:80 per cent. carbon—or water—if of 0:35 per cent. to 0:70 per cent. carbon—and then withdrawn and allowed to cool to a blue color to temper it, and finally quenched in water as soon as the requisite color is attained.

Steel strips or steel wire are hardened and tempered by passing through a six-foot coal or gas furnace, where they are heated red hot, then chilled under a die through which a stream of cold water runs to harden them, slightly reheated in another furnace to temper them, and finally chilled again.

The effect of hardening is to render the steel brittle, while tempering makes it again springy and tough.

Forging—After the ingots, blooms, or billets are cold they are sent to a forge or rolling mill to be hammered under a drop-hammer or rolled into squares, flats, three-squares, rounds, or other sections. All high class steel is hammered before being rolled to close up the grain and weld up defects.

Ingots for razors, surgical instruments and fine tools are hammered down to 1½ in. square, all "roaks" ground out, and re-hammered to 1⅛ in. square before being rolled into razor bevils, wire rods, etc.

Rolling—A set of rolls consist of two or three tiers of rolls rotating in opposite directions. At one end are the "breaking down" or "cogging" rolls through which the steel bar is passed first, and which are comparatively wide apart. After passing through the cogging rolls the bar is passed backwards and forwards through rolls set closer and closer together, until it emerges as a long rod or strip. In the case of a strip it is coiled round a metal core from which it is released when cold. Hot rolling in strips can only be carried out to about 17 gauge (0:56 in.), and if a thinner gauge is required the strip must be cold rolled. Sheets, however, may be rolled in sets of three or four layers to obtain thinner sheets down to 28 gauge (:014 in.). Before cold rolling can be proceeded with the coil is placed in an annealing furnace to soften it, and it is then cold-rolled to the required gauge, an additional annealing taking place between each three or four guages.

Steel can be rolled cold down to about 35 gauge (:008 in.) within an accuracy of 0:001 of an inch. It is used for clock springs, cartridge clips, bicycle and motor chains, corset steel, etc.

Wire drawing—The steel comes to a wire-drawing mill in round rods of about 5 gauge (:212 in.), where it is first annealed and then drawn through plates known as "draw-plates," with various sized holes in them, until the required guage is attained. As in rolling, the rods have to be reannealed frequently when being drawn to a fine gauge for drills, music wire, needles, etc.

In conclusion it may be mentioned that more harm is done to steel by over-heating than from any other cause. This may occur during any one of the processes—melting, forging, rolling, hardening, annealing, or grinding.

If a tool is to be hardened thoroughly it must be heated slowly and the heat allowed to soak thoroughly right through the metal, or it will inevitably crack when plunged into water if the surface only is hot. The tool should always be vibrated when hardening.

Naval Consulting Board Bulletins

The Naval Consulting Board has issued the first of a series of bulletins concerned with its work that is entitled "The Submarine and Kindred Problems." In the pamphlet of twelve pages the board has collated some primary facts about submarines and already existing devices for protection against them, with the idea that they may be studied by inventors to the end that impractical ideas may be eliminated from submission to the board. The pamphlet gives a brief but complete summary of the facts as to electro magnets and magnestism in relation to submarine defense and summarizes "electrical effects in general." It devotes five pages to "Protection Against Submarine Attack"; two pages to "Mines and Torpedoes for Naval Operations"; and sections are devoted to "Confining the Submarines" and "Ships and Shipbuilding." As to confining the submarines before they reach the open sea, the bulletin says, quoting the opinions of officers of our Navy and those of foreign navies who have visited this county: "The submarine bases are very strongly protected by land batteries, aeroplane observers and large areas of thickly mined waters extending to such distances that the largest naval gun cannot get within range of the bases. In spite of these protections, there is now going on a continuous attempt on the part of the Allied navies to entrap or otherwise defeat the submarines as they emerge from the protected areas. Nets are laid and as promptly removed by the enemy, whose trawlers are in turn attacked by our destroyers. The design of these nets and the detailed arrangement of their fastenings and attachments offer a broad field for invention, but it should be remembered that they must be capable of being used in waters in which there is a tidal current running from two to five miles per hour. Many suggestions for 'bottling up' these bases have been offered, but, as will be realized, it is not desirable to publish information which would indicate even in the smallest degree this country's plans."

A GRAPHICAL METHOD OF DETERMINING BENDING MOMENTS IN CONTINUOUS BEAMS*

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THE method of determining bending moments indicated in the accompanying figures is not, I believe, generally n to engineers in this country, the mathematical solution being usually employed. The graphical method has the advantage that it can be delegated to anyone without a mathematical training, and is much easier to check, as any error in construction is at once obvious to the experienced eye. In the figures five unequal spans are indicated, but of course the method applies to any number of spans. Briefly speaking, the method is as follows: Set out the spans to any convenient scale and determine the "fixed points" as shown in Fig. 1. Each span is divided into three equal parts by the divisional points h_1, h_2, h_3, &c. From h_2 set off to the left $h_2k_1 = \frac{l_1}{3}$; from h_3 set off to the left $h_3k_2 = \frac{l_2}{3}$; from h_4 set off to the left $h_4k_3 = \frac{l_3}{3}$, &c. Through the points k_1, k_2, k_3, k_4, &c., thus found draw vertical lines. From *A* draw a line at any convenient angle intersecting the vertical line through k_1 at g_1. Through the righthand divisional point h_1 of the span *AB* draw another vertical line intersecting Ag_1 in f_1. Produce f_1B until it intersects the vertical line through the left-hand divisional point h_2 of the span *AB* in m_2, and join g_1m_2 cutting the line *BC* in *T*, which is the left-hand fixed point of span *BC*. Draw Tg_2 at any convenient angle, and continue as previously, finding *V*, the left-hand fixed point of the span *CD*. In the same manner find *X* and *Z*. The right-hand fixed points, *S*, *U*, *W* and *Y*, are found in a similar manner, starting by drawing a line from the point *F* through m_5 intersecting the vertical line through k_4 in n_5. Join f_4n_5 cutting *DE* in *Y*, which is the right-hand fixed point of span *DE*.

The right-hand fixed point, *W*, of span *CD* is found by drawing a line from *Y* through m_4 proceeding as previously, and in the same manner all the remaining fixed points are located. When this has been accomplished, the next step is to utilize the "fixed points" for determining the effect of the bending moment in one span on the other spans of the continuous beam. This is done by constructing on any particular span the freely supported bending moment diagram due to the load on that span. The closing line will, of course, depend on the distribution of the load on the span in question, and methods are indicated for different load distributions in Figs. 2, 3, 4, 5 and 6.

In connection with bending moments in aeroplanes Fig. 2 is the most important, since it deals with a uniformly distributed load. Commencing with any of the spans the bending moment on that span is first determined. In the case of a uniformly distributed load the diagram is, of course, a parabola. The point *K* is on the center line of the span. Join *KB* and *KC*, cutting perpendiculars through *T* and *U* in *L* and *M* respectively. *NLMO* is then the closing line. By continuing the closing line through the appropriate fixed points and supports, the bending effect in adjacent spans is at once given. If no other spans are loaded the solution is then complete. As, however, the other spans usually are loaded, at any rate in an aeroplane, it becomes necessary to determine the effect of these loadings. This is done by constructing on all spans the appropriate freely supported bending moment diagram and determine the closing lines, which continue through fixed points and supports.

Now sum up all the bending moments at any particular point, having, of course, due regard to sign. When the closing line is below the base line the ordinate between it and the base line represents negative bending moment and *vice versa*. The method is illustrated in Figs. 7 and 8. In aeroplane spars subjected to direct axial compression, the bending moment due to lateral load at the center of the spar is increased by an amount equal to the compressive force multiplied by the total

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*Courtesy Flight (London).

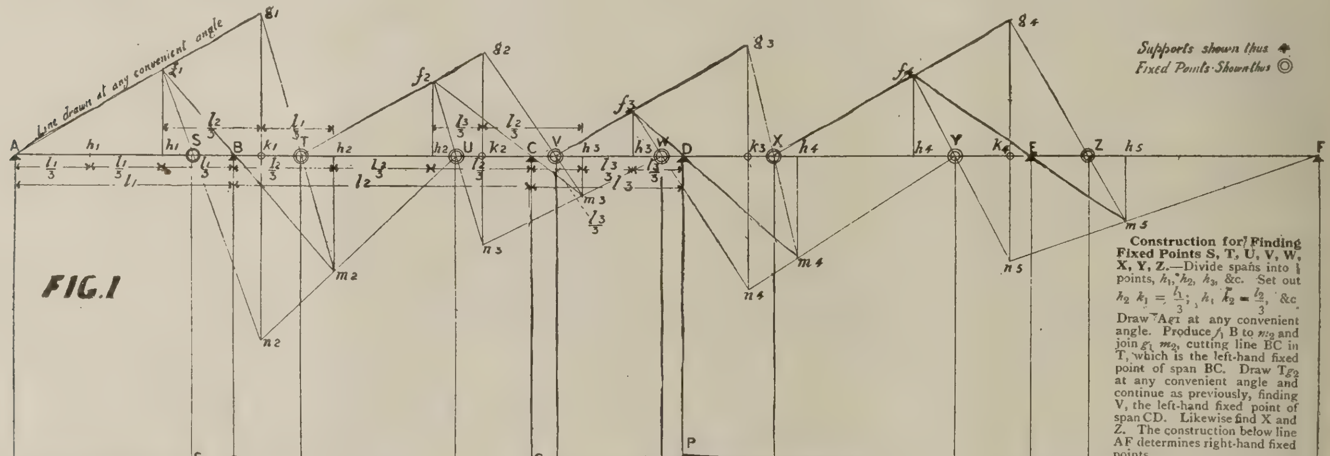
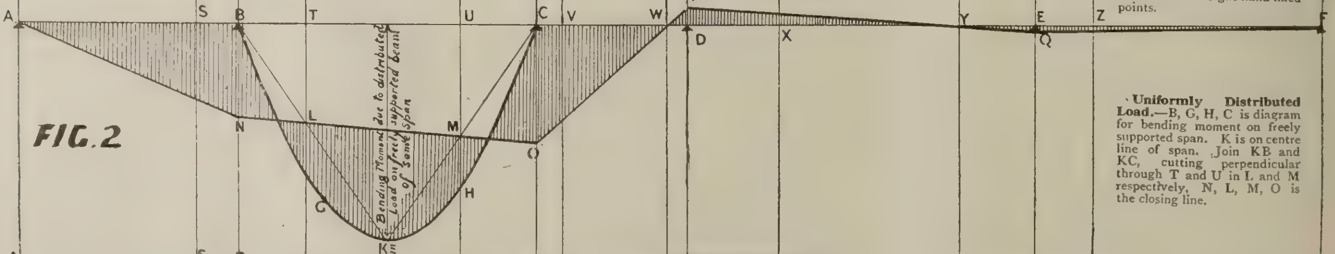


FIG. 1

Construction for Finding Fixed Points S, T, U, V, W, X, Y, Z.—Divide spans into ⅓ points, h_1, h_2, h_3, &c. Set out $h_2\,k_1 = \frac{l_1}{3}$; $h_3\,k_2 = \frac{l_2}{3}$, &c. Draw Ag_1 at any convenient angle. Produce f_1 B to m_2 and join $g_1\,m_2$, cutting line BC in T, which is the left-hand fixed point of span BC. Draw Tg_2 at any convenient angle and continue as previously, finding V, the left-hand fixed point of span CD. Likewise find X and Z. The construction below line AF determines right-hand fixed points.


A
S
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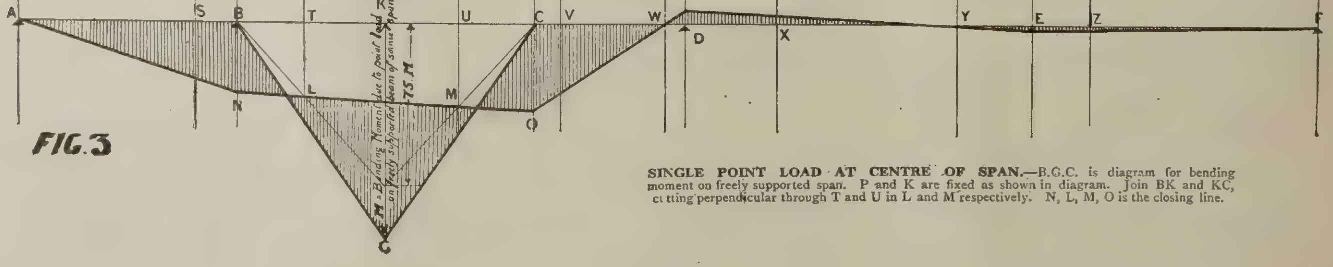
G
H
K
Bending Moment due to distributed Load on freely supported Beam of same Span

FIG. 2

Uniformly Distributed Load.—B, G, H, C is diagram for bending moment on freely supported span. K is on centre line of span. Join KB and KC, cutting perpendicular through T and U in L and M respectively. N, L, M, O is the closing line.


A
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N
L
M
O
K
G
B.M. Bending Moment due to point load on freely supported beam of same span
.75 M

FIG. 3

SINGLE POINT LOAD AT CENTRE OF SPAN.—B.G.C. is diagram for bending moment on freely supported span. P and K are fixed as shown in diagram. Join BK and KC, cutting perpendicular through T and U in L and M respectively. N, L, M, O is the closing line.

deflection, but the bending moment at the supports remains practically unaltered. The exact solution is involved, but as a first approximation it may be assumed that, owing to the increase in the center bending moments, the points of contraflexure move half-way towards the supports. If l_1 is the length of the span, and l_c the length between the points of contraflexure on the continuous bending moment diagram, the assumption is that the length between the points of contraflexure of the axially loaded beam is $\frac{l_1 + l_c}{2}$. The following formula for a laterally loaded strut can then be applied to a strut of length $\frac{l_1 + l_c}{2}$.

$$f_c = \frac{w\left(\frac{l_1 + l_c}{2}\right)^2}{8Z}\left(\frac{P_e}{P_e - P}\right) + \frac{P}{A}$$

Where—

f_c = maximum compressives stress in lbs. per sq. in.

w = lateral load on spar in lbs. per inch run.

Z = section modulus of spar.

P_e = Euler's limiting value for the spar on length $\frac{l_1 + l_c}{2}$ considered free ended.

P = end compression on spar in lbs.

A = area of spar section in sq. inches.

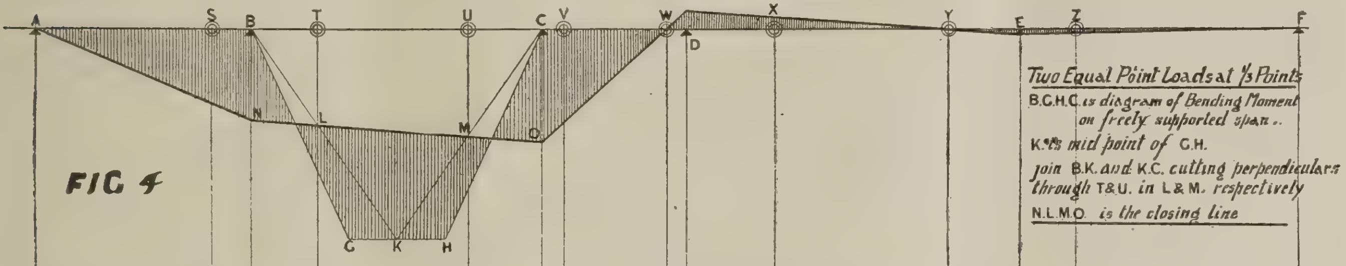


FIG 4

Two Equal Point Loads at ⅓ Points

B.C.H.C. is diagram of Bending Moment on freely supported span..

K. is mid point of G.H.

join B.K. and K.C. cutting perpendiculars through T&U. in L&M. respectively

N.L.M.O. is the closing line

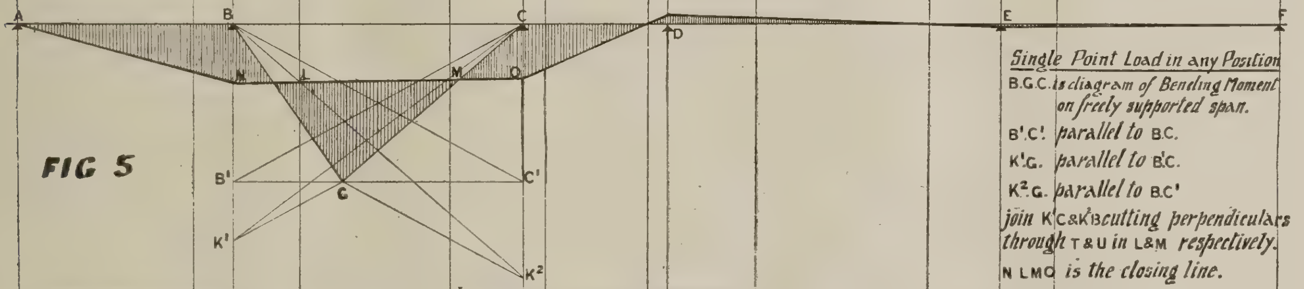


FIG 5

Single Point Load in any Position

B.G.C. is diagram of Bending Moment on freely supported span.

B¹.C¹. parallel to B.C.

K¹.G. parallel to B¹C.

K².G. parallel to B.C¹

join K¹C & K²B cutting perpendiculars through T & U in L&M respectively.

N LMO is the closing line.

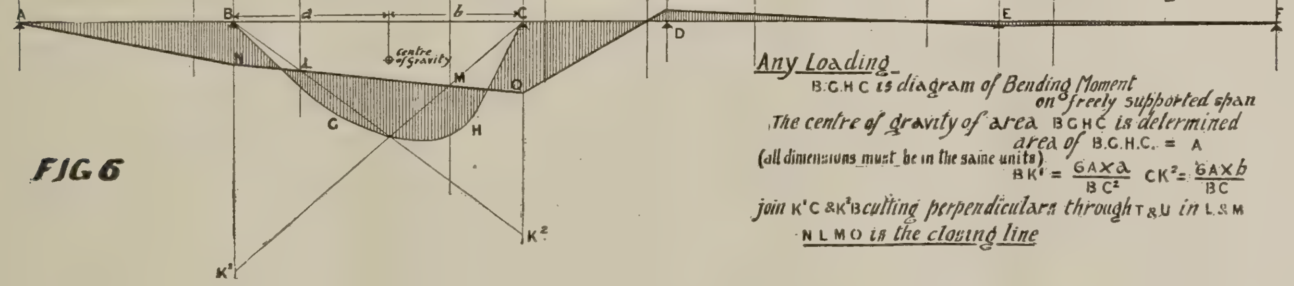


FIG 6

Any Loading

B.G.H.C is diagram of Bending Moment on freely supported span

The centre of gravity of area BGHC is determined

area of B.G.H.C. = A

(all dimensions must be in the same units)

$BK^1 = \frac{6A \times a}{BC^2}$ $CK^2 = \frac{6A \times b}{BC}$

join K¹C & K²B cutting perpendiculars through T & U in L & M

N L M O is the closing line

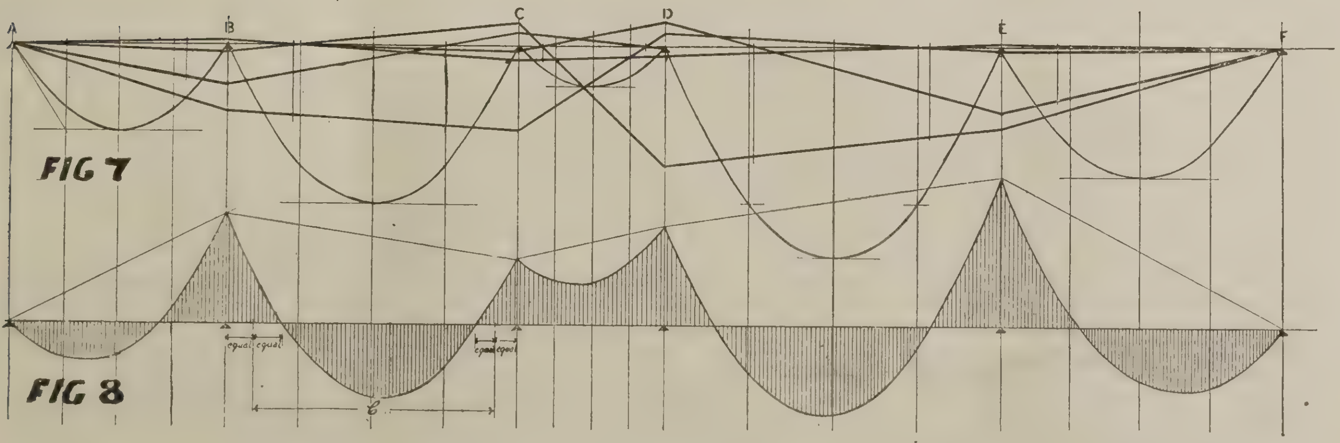
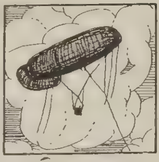
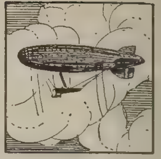


FIG 7

FIG 8



MILITARY AEROSTATICS



SOME POINTS IN AIRSHIP ENGINEERING

By E. T. Willows

The construction of the rigid type airship is somewhat analogous to the building of a steel ship. It is built up of a number of ribs, usually referred to as transverse members, constructed on the box-girder principle.

In place of the longitudinal "stringers" which shape the hull of a sea-going ship, there are longitudinal members of similar type to the transverse, connecting the latter together, and the outside is covered with a cotton fabric waterproofed and fireproofed, laced in sections, so as to present a taut surface to the air.

After the transverse and longitudinal members are joined together in sections, they are braced by diagonal wires, and at the divisions formed by the separate gas bags there is a system of wiring similar to the spokes of a wheel, which, again, are wired round at different radii, giving the whole the appearance of a spider's web.

The inner and outer members of the girders in the large ships are spaced about 1 ft. apart, so that when the gas bags are full and bearing against this inner member and the wire bracing, there is a space left between them and the outer cover, which makes it more difficult to pass an incendiary body through to ignite the hydrogen gas.

In the ordinary way this layer of air is useful in acting as an insulator in keeping the temperature of the gas more constant. This is one of the great difficulties of the non-rigid system, as in this case, owing to there being only the one layer of fabric separating the gas from the outside air, any external increase or decrease of temperature is immediately transmitted to the gas, which is at once affected by expansion or contraction.

Gas-Containers

The compartments formed by the transverse girders, which are "spoked," contain a cheese-shaped gas-container made of rubberized cotton. These are usually referred to in rigid ships as "ballonets," but must not be confused with the ballonets in the non-rigid system of constructing airships, as in the latter case they contain air, so that when the gas expands air is forced out, and no gas is lost until all the air is these air ballonets is expressed—or squeezed out.

The number of the gas compartments has hitherto been 17 in the older German ships.

To prevent the gas-containers from chafing against the wire bracing and girders, a light cord netting is stretched over the bags and secured to the girders, which netting also helps to distribute the lift of the gas over the top portion of the hull.

Each of these gas-containers is fitted with a valve at the top, which opens automatically when the bag expands to its maximum. This is accomplished by the attachment of the valve line to the lower part of the envelope in such a way that its length can be adjusted to open the valve at a given height.

The valve-line can also be operated by hand if necessary, the controls for the various gas bags being brought down, some to the front gondola, and the remainder to the after one.

The inspection of these gas bags, with their various attachments, is made possible by a gangway, or keel, running about two-thirds the length of the lower part of the envelope, to which keel there is access from the gondolas. An alternative system which is used in some Zeppelins is to have this gangway on the inner side of the hull itself.

It will, no doubt, ere long be possible to arrange that the power plant on these big ships shall be practically free from the danger of setting fire to any combustible mixture of gas or petrol vapour which may accumulate. However, there will always be a danger as long as hydrogen is used, and every precaution is naturally taken to ensure that if leakages should occur the gas can escape to parts of the hull where there is no danger of it being ignited.

From the gangway or keel access may be had to each gas-bag compartment, so that when they are slack, at the lower altitudes, they can be inspected for a considerable area, and by means of inspection-glasses let into the fabric the interior can also be well inspected, as well as the valve and valve-cords.

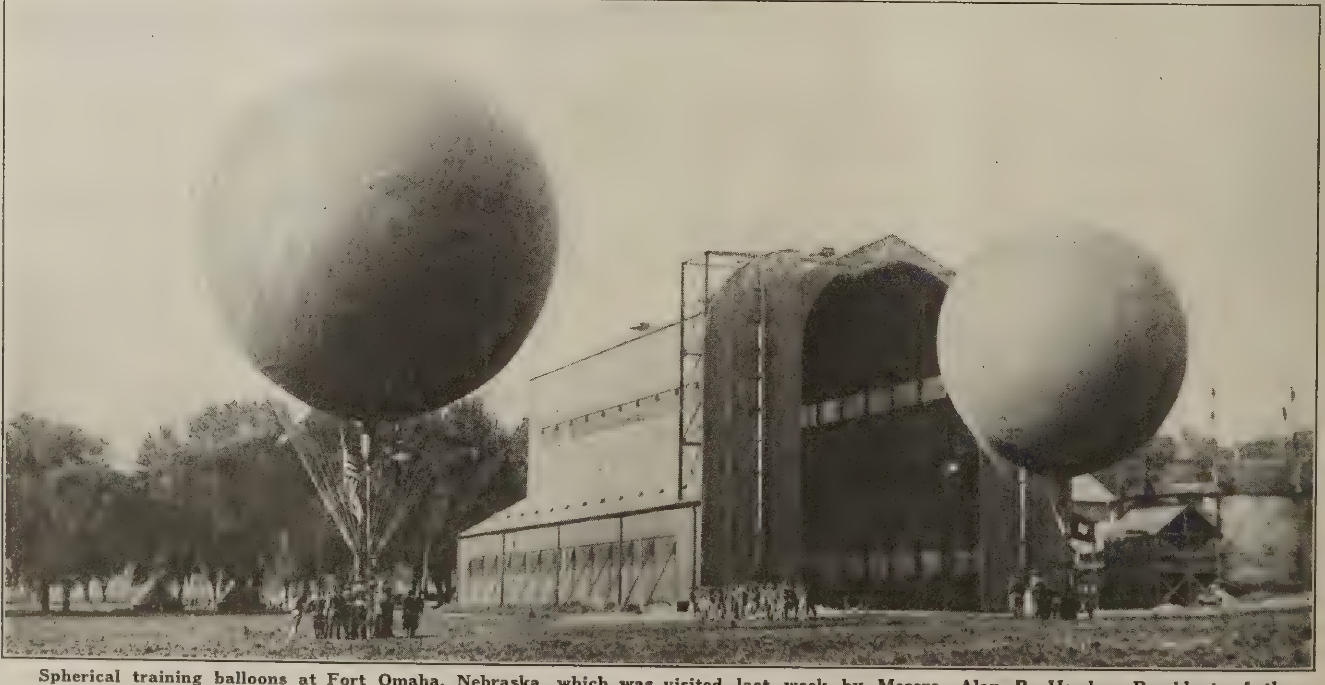
Should there be a small hole or rent, it can be located through the inspection-glasses, as it will show up against the rest of the fabric as a light spot. One of the crew can then locate this upon the outer surface of the gas bag by climbing along the girders and the hole can be patched as required. In this way damage to the airship by shrapnel pieces or bullets can, in the course of the voyage, be remedied. In the case of small holes or rents it is surprising what a comparatively small amount of gas escapes.

The gas bags are usually made of a two-ply cotton fabric, made hydrogen-proof with rubber and vulcanised. The two plies are at 45 deg. to one another. Although this does not give the strength that it would have if the vulcanised together diagonally gives a greater resistance to tearing, as in the event of a rent occurring the fabric has not the tendency to continue tearing that it would have in the case of the fabrics being superimposed with the weft and warp in the same direction, or in using a single fabric equal to the strength he two layers.

The outer covering does not, of course, need to be hydrogen-proof, and need not be two-ply. It is made water and airproof and arranged so that it can be laced tightly in sections over the hull framework. When it is necessary to make a detail inspection of any gas bag, that particular section can be removed and the fabric of the gas-containers easily looked over from ladders or the sides of the airship dock.

When airships are built in such sizes that the present day "rigids" appear small or medium size craft, which is more than probable in the near future, it may be possible to utilise a very finely rolled sheet metal for the exterior covering. This will overcome easily one of the present difficulties in dealing with the question of fire prevention.

(To be continued)



Spherical training balloons at Fort Omaha, Nebraska, which was visited last week by Messrs. Alan R. Hawley, President of the Aero Club of America, Henry Woodhouse, and Congressman Murray Hulbert, as related in a news item in this issue.

FOREIGN NEWS

BELGIUM

Another bombing expedition was made over Belgium on Saturday night, August 25th, by British aviators.

The official report says: "A bombing raid was carried out at midnight Saturday by the Naval Air Service at the St Denis Western Airdrome. A large number of bombs were dropped. One of the British machines is missing.

FRANCE

The first death of an American naval flier at the French front was announced in Washington, Aug. 27th, in official dispatches to the Navy Department. He was George Herbert Manley, a machinist's mate in the Naval Aeronautical Corps, and was killed in an aeroplane accident, the nature of which was not described.

Manley was a son of Herbert Manley, of Maplewood.

The fine romance and color of the ancient wars is to-day found only in the aviation service. The fighters of the air lead a tense and dangerous existence, but their days are filled with deeds of heroic self-sacrifice and gallant daring. To gain an idea of how these men die, read this letter, which was left by Lieutenant Raymond Havet, a French aviator, killed in aerial combat:

"My Captain: This boche has not been more clever than the others. It was I who was awkward, and I beg you to excuse me. No tears, no crowns, no flowers. Only a little champagne later on. A handshake to all my comrades. R. H.

"Dulce et decorum est pro patria mori."

Lieut. Raoul Lufbery, of the Lafayette Escadrille, saved his colleague in a patrol flight, Sergeant Robert Soubiran, of South Boston, from probable death on Aug. 26th, when Soubiran was suddenly attacked by four German machines of the albatross type, while he was flying at a low altitude. The German machines were over Soubiran, attempting to down him, when Lufbery, seeing his companion's plight, darted at the enemy aviators, scattering them and allowing Soubrian to escape.

Lieut. Lufbery was warmly praised by the officers and men of the command for his bravery in attacking single-handed four enemy machines.

Dr. Edmond Gros of Paris, who was instrumental in organizing the successful Lafayette Flying Corps with American volunteers, has been appointed a Major of the American Army in the Aviation Signal Corps. He will give up his practice for the duration of the war.

GREAT BRITAIN

Judging by reports appearing in the British press and periodicals as well as the remarks of prominent persons, the tendency is toward an aviation department that will have absolute control of British aerial activities

The British publication, *"Flight,"* has had as its slogan for many months, "One air service; one uniform; one badge." In a recent issue of the Sunday Observer, Lord Montague defines his idea of the suggested aerial board, as follows:—

"President of the Board of Aviation—Cabinet Minister of first rank.

"First Professional Assistant in charge of heavier-than-air service.

"Second Professional Assistant in charge of lighter-than-air service.

"Third Professional Assistant in charge of officer for supplies.

"Fourth Professional Assistant in charge of officer for supplies.

"Fourth Professional Assistant in charge of operations and intelligence.

"Civil assistants and duties:—

"A Vice President (In the House of Lords, or Commons), general assistant to President. Personnel, organization and intelligence.

"A Financial Secretary (in the House of Commons), to finance supplies, and all questions relating thereto.

"The President and his Board should be responsible for the Royal (or Imperial) Air Service in every sense. The air fleets, wings and squadrons would be directed by the Commander-in-Chief when working in co-operation with the navy and army in the same way as at present orders for air operations would pass in future from the senior admiral or general through the senior naval or military air service representative on the spot."

The Aeroplane publishes a list of 148 British aeroplanes which fell into the hands of the Germans during April, 1917, which has been published in the German press. As the list furnishes a record of the types of machines used by the British, we list below the types and the number captured: 35 B.Es; 16 Sopwith two seaters; 8 Sopwith single seaters; 1 Sopwith Triplane; 27 F.Es; 5 Nieuport two seaters; 19 Nieuport single seaters; 13 Bristols; 4 Spads; 11 Vickers; 1 Martinside single seater; 1 "Xanaibar" VII; 1 R.E. 8; other machines not ascertainable.

The list of Allied aeroplanes which fell into the hands of the enemy during May, 1917, gives 113 machines in all: 89 British, 21 French, 1 Belgian and 2 Russian. Eight Sopwith two seaters; 21 Sopwith single seaters; 1 Sopwith Triplane two seater; 7 Sopwith Triplane single seaters; 14 F.E. two seaters; 1 FE. single seater; 10 Nieuport single seaters; 6 B.E. two seaters; 2 Bristol single seaters; 3 Vickers two seaters; 2 Vickers single seaters; 2 Spad two seaters; 3 Spad single seaters; 2 S. Es; 1 R. E.; 1 Farman; 1 deHaviland Scout; the list also gives 21 French Avions, including Spads, Nieuports, Morane, Paul Schmidt, Moineau and Voisin.

The *Daily Express* published on July 28 a list of British air losses which was published in the official *Norddeutsche Allgemeine Zeitung* of Berlin. The total number of machines mentioned is 83. The list includes the following: 4 Sopwith two seaters; 22 Sopwith one seaters; 1 Sopwith Triplane two seater; 5 Sopwith Triplane one seaters; 22 Nieuport one seaters, 7 Spad one seaters; 2 F. E. two seaters; 4 F. E. one seaters; 4 R. E. two seaters; 2 R. E. one seaters; 5 S. E. one seaters; 3 B. E. two seaters; 1 Vickers one seater; 2 D.D.; 1 Martinside one seater, and one deHaviland Scout.

Some of the motors mentioned in connection with the machines give an indication of those most used. B. Es. equipped with Austin motors; Bristol-Rolls-Royce motor; Vickers, Rolls-Royce; Sopwith, Clerget motor; Sopwith, Le Rohne and Gnome-le-Rohne motors; Sopwith Triplane, Hispano-Suiza and Clerget motors; Nieuport, LeRohne; B.E., RollsRoyce motor; Bristol, Hispano-Suiza; Sopwith, Wolseley Hispano motor. The D.D. two seater is equipped with a Rolls-Royce motor.

ITALY

August 29—Captain Guilio Laureami, an aviator in the Italian army, has established a new world's long distance flying record by flying more than nine hundred miles without stopping, according to a despatch to the *Temps* from Milan. The Italian flew from Turin to Naples and return, a distance of about 920 miles as the crow flies. Captain Laureami used a new S. I. A. machine with a Fiat motor. He left Turin at seven minutes past ten A. M., reached Naples, flew over that city and was back in Turin at twenty minutes to nine P. M.

The previous long distance non-stop flight record was held by Second Lieutenant Antoine Marchal, a French aviator. In June, 1916, Marchal flew from Nancy, France, to near Chelm, Russian Poland, in a Nieuport machine. The distance covered was about 807 miles. During the flight Lieutenant Marchal dropped proclamations on Berlin. He was made prisoner by the Austrians at Chelm and was interned at Salzerbach.

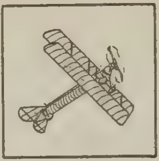
The American long distance, non-stop record is held by Miss Ruth Law, who flew 590 miles from Chicago to Hornell, N. Y., on November 19, 1916. Her elapsed time was five hours and forty-five minutes.

Leon Bailby, writing in *L'Intransigeant* on America's participation in the war, says:

"When Americans first suggested finishing the war by aviation charges, attacking Berlin through the air, many of us doubted the practicability of the plan. We knew what determination and resources our new allies had and that they would do everything in the shortest time possible to build formidable aerial squadrons, but we also realized the difficulties in the way.

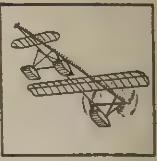
"From month to month the airplane has become a more perfect fighting machine. Woe to the belligerent that lags behind in perfecting its planes, for mastery of the air is the quickest to change hands. Time therefore is necessary before Americans can make a sufficient number of machines of our models and can train enough pilots, but with these reservations we expect a great deal of American aviation and of our own."

A British warplane with a "V" type motor. Note the damping shutter, which regulates the amount of air admitted to the radiator, besides acting as a protective shield against shrapnel. Queen Mary and General Trenchard inspecting the machine.



MODEL NEWS

Edited by G. A. Cavanagh



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A Wireless Controlled Model

(Concluded from Page 930)

This breaks the circuit, therefore the pawl spring forces the pawl onto the ratchet wheel, which completes its first movement, the pawl now engaging another tooth. The metal arm within the wooden hoop now makes a contact with another metal segment.

We will suppose the arm is in contact with the segment marked "stop." Now if the tapping key is depressed the arm moves to the "forward" terminal. Another depression and it will connect the terminal marked "right," which is connected with the *left* motor, and causes the dirigible to turn to the right. If the arm is in the "forward" position, and the operator wishes the machine to turn to the left, one depression of the key brings the arm to the "right" position, but this is not the one required, therefore another depression is necessary before the position is obtained.

With reference to the wireless control of aeroplanes, I might say that about eighteen months ago I commenced experimenting with an apparatus intended to be fitted into a model aeroplane. Experiments with this apparatus, even though not so successful as I hoped, have shown me that it is possible, if one has enough time and money, to control models by wireless. I am hoping, when the war is over, to build a machine fitted with apparatus of improved design, which, perhaps, will achieve the success required.

[The foregoing will, we are sure, be read with the greatest interest by our model readers, and should be of great assistance to those thinking of experimenting in this direction. Especial notice should be taken of the fact that more than one depression, or in some cases more than two, of the "tapping key" may be necessary to bring the controlling mechanism to the correct position. In the use of a model aeroplane, *lightness* would have, of course, to be *the* especial feature of the apparatus.]

Experiments With Divided Tail Models

By George H. Kilshaw, Liverpool Aero Research Club.

Before starting a description of the various designs of divided tail models experimented with, it may be mentioned that the first of these was suggested after a series of interesting stability experiments with paper gliders. It appeared that this design was capable of adaption to a military type machine, some of the chief points likely to be of advantage being: 1. Clear view ahead, enabling free forward gun fire. 2. Increased stability. 3. Employment of a short *fucelage.* 4. No disturbing influence from the propeller draught on the tail.

The first machine is shown in scale at Fig. 1; it had a span of 34 in. and a total length (front of plane to rear of tail) of 17 ins.; and a carved propeller 11 ins. diam, and 20 ins. pitch. A clear idea of the reversed camber employed at the tail end is shown in sketch Fig. 2. In Model 2 these were discarded owing to the reaction bringing the main weight more forward than was thought advisable, although the stability shown was very good, especially while banking.

In Model 2, the length of the flight was better, showing greater efficiency, there being no apparent difference in the stability, the only alteration being the omission of the shaded tail portions in Fig. 1.

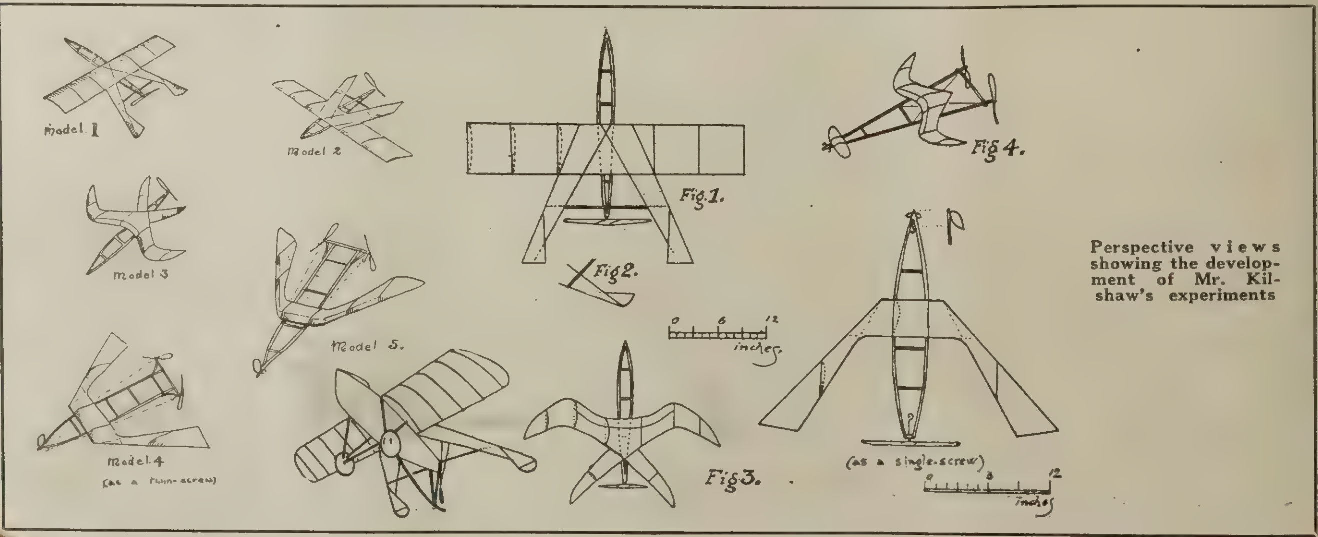
A 5 ft. 8 ins. span scale model built to Model 2 design is shown. There was noticed, however, in the previous two machines mentioned, a certain amount of sluggishness, and although Model 2 showed improvement in this respect, it was decided to pursue this question further.

The most likely cause of this was thought to be due to the close proximity of the main planes in relation to the tail, and with this in mind Model 3 was designed and built, and is shown to scale in Fig. 3.

In order to give as much clearance between the main and tail surfaces as possible, the main planes were swept forward from the centre, and in order to counteract any tendency to spin were retreated near the tips, with a negative angle of incidence.

Results with either single or twin propellers were not very encouraging, the directional stability being very poor, with increased sluggishness.

(To be continued)



Perspective views showing the development of Mr. Kilshaw's experiments

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested

Why Not?

They started out by having the requirement for Aviation Service so strict that hardly anyone could get in. But not getting any aviators they have gradually reduced the strictness of the examinations so that almost any day we expect to see something like this:

1. How much is 2 + 2?
2. How much is 2 — 2?
3. Can you spell your own name?
4. Have you reached the age of 8?
5. Can you walk? (If not, can you crawl?)
6. Do you drink anything stronger than straight whiskey? Why not?
7. What is your high-run at billiards?

The applicant shall be required to pass the following tests:

He must have two eyes, two arms and two legs in fairly serviceable condition.

He must be able to read first reader English.

He must have one (1) heart and two (2) lungs, which must beat and breathe respectively.

If the candidate cannot pass the above tests, and still desires to get in, he may apply again and state that he passed he first tests, when he will be given a commission as a Field Marshal.

The Observer's Lot

(With apologies to W. S. Gilbert.)

When observers are quite new to their vocation, their vocation,
And have very seldom flown in a machine, in a machine,
They are absolutely struck on aviation, aviation
And will fly with any pilot, they're so keen, they're so keen.
Some pilots one decidedly should smother, one should smother,
When there's any sort of duty to be done, to be done,
Taking one consideration with another, with another,
An observer's lot is not a happy one.
There's the pilot who is new to his profession, his profession,
And has often smashed a 'plane to little bits, little bits,
It becomes with him a terrible obsession, 'ble obsession,
To take us up and scare us into fits, into fits.
One pilot is the same as any other, any other,
When there isn't any duty to be done, to be done,
Taking one consideration with another, with another,
An observer's lot is not a happy one.
When a pilot gets defective circulation, circulation,
He's always given something soft to do, soft to do,
But observers in a similar location, 'lar location,
Are asked "What earthly use are you? Use are you?"
They treat a cold-foot pilot like a brother, like a brother,
When his useful flying life at length is done, length is done.
Taking one consideration with another, with another,
An observer's lot is not a happy one.

Things We Want to See

A hair from the head of a hammer.
A plume from the wing on a Curtiss.
A bite from the teeth of a saw.
A wink from the eye of a needle.
And a page from a volume of steam.

Girls Built to Specification

Thomas is a very accommodating firm. When arriving there, if you are single pass the Joiners, they will fix you up. If you do not fancy your Flapper, see the Fitters and they will reconstruct her. She can be painted to suit and afterwards welded. At the end of this process, if unsuitable, the Drawing Office will no doubt give you another type of body. When, after submitting to the Technical Department for their approbation and she is still found to be unsuitable, well you will get a fine figure for her in the Buying Office.

A Word from the Wise

You can't judge a fellow's education by the labels on his suitcase.

A Ford will take you anywhere except into society.

Some people thought they could buy the Christmas spirit in bottles.

The maiden fair and the made unfairly profits of the gold-brick artists may both be classified as damsels. (Deep, very deep.)

Why does a "high-brow" who can speak seven languages usually spend his old age in the poorhouse, while the "low-brow" who can keep quiet on one, passes his declining years being investigated by the Anti-Trust Committee?

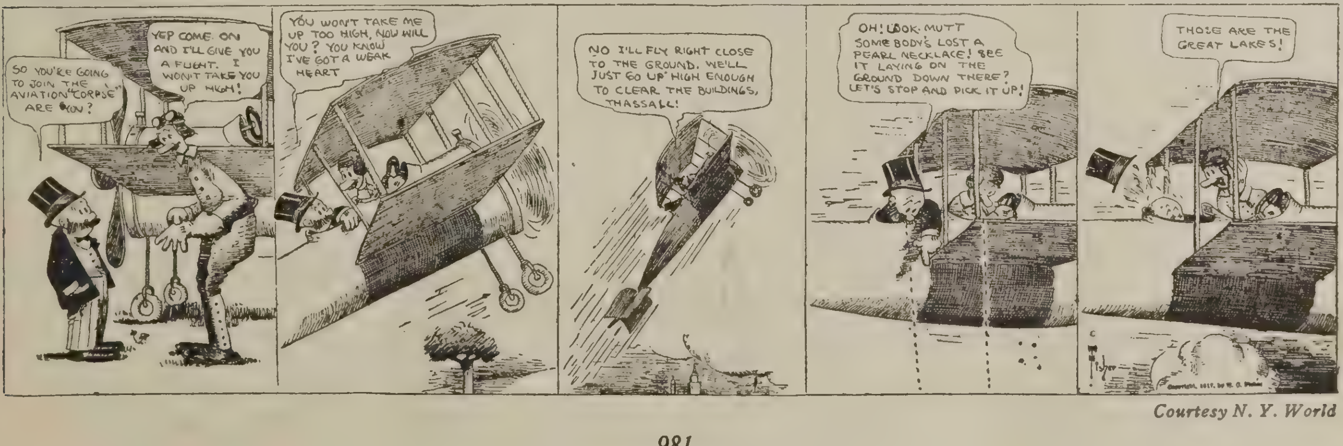
Pilot—"We shall be half a second late at London, What is the trouble?"

Mechanic—"We just passed thru the milky way and propeller is full of butter."

Young Thing (seated between two elderly gentlemen at dinner) "This reminds me of a rose between two thorns."

On the right—"Rather a tongue sandwich!"

MUTT AND JEFF—Jeff Couldn't Tell the Great Lakes From a Pearl Necklace From Where He Sat : : : By BUD FISHER


SO YOU'RE GOING TO JOIN THE AVIATION "CORPSE" ARE YOU?
YEP COME ON AND I'LL GIVE YOU A FLIGHT. I WON'T TAKE YOU UP HIGH!
YOU WON'T TAKE ME UP TOO HIGH, NOW WILL YOU? YOU KNOW I'VE GOT A WEAK HEART
NO I'LL FLY RIGHT CLOSE TO THE GROUND. WE'LL JUST GO UP HIGH ENOUGH TO CLEAR THE BUILDINGS, THASSALL!
OH! LOOK MUTT SOMEBODY'S LOST A PEARL NECKLACE! SEE IT LAYING ON THE GROUND DOWN THERE? LET'S STOP AND PICK IT UP!
THOSE ARE THE GREAT LAKES!
Fisher

Courtesy N. Y. World

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THREE MEDALS OF MERIT were awarded by the Aero Club of America for the following notable records:

J. FLOYD SMITH, who created three new World hydro altitude records in a Martin seaplane: January 12, 1916, with one passenger, 12,333 feet; January 11, 1916, two passengers, 9,524 feet; February 16, three passengers, 9,608 feet.

C. C. CULVER, Captain, U. S. A., for his great achievements in developing wireless equipment for sending and receiving messages from aeroplanes. All his experiments and achievements were made using a Martin Military Tractor Biplane.

A. D. SMITH, Corporal, U. S. A., who created a new hydro duration record February 19, 1916, in a Martin seaplane by remaining in the air 8 hours and 42 minutes.

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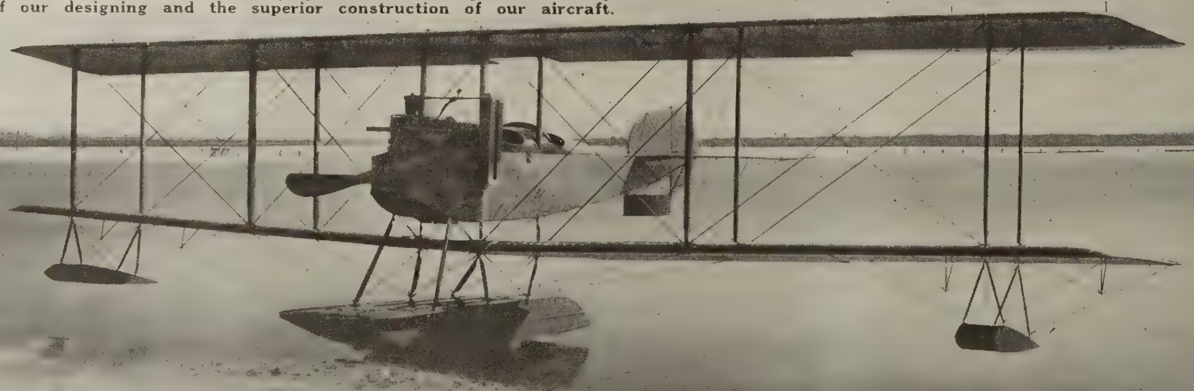

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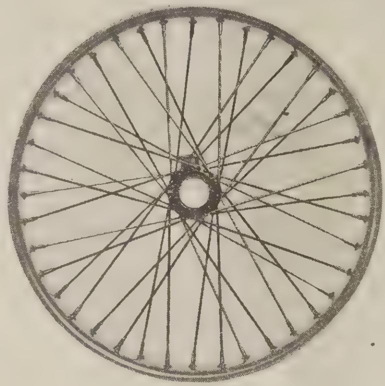

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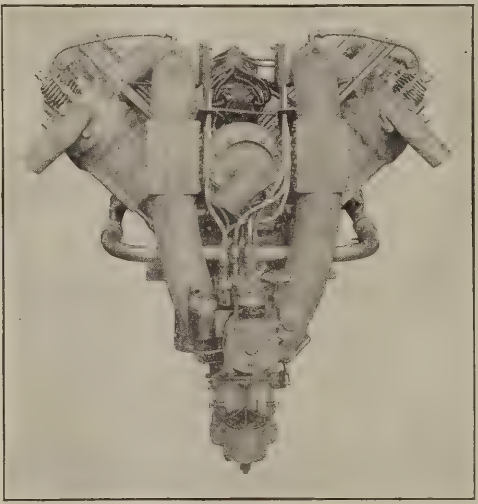

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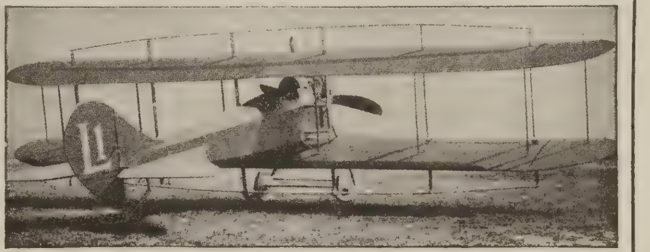

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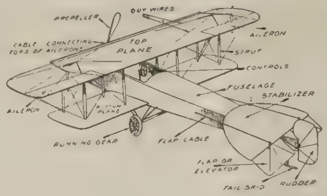

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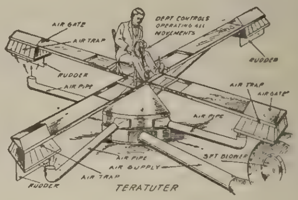

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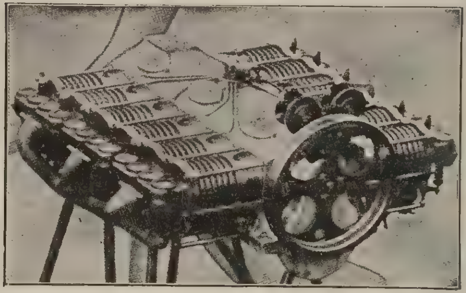

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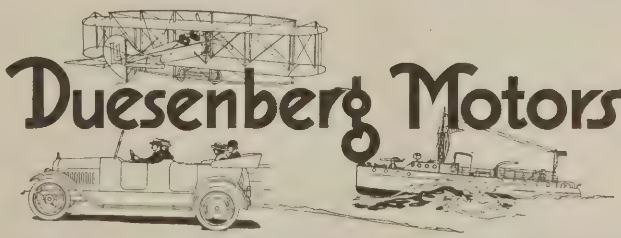

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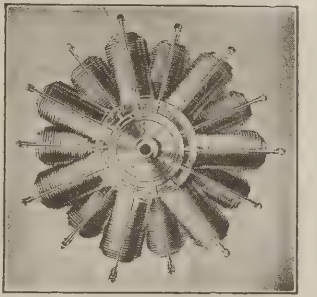

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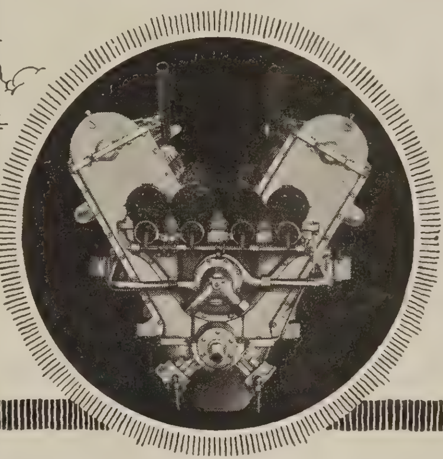

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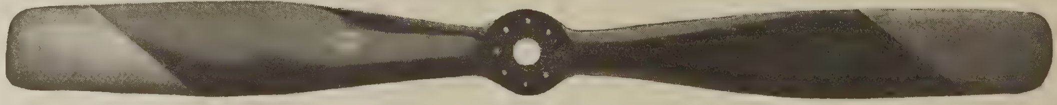

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